NUCLEAR PAKISTAN

SEEKING SECURITY & STABILITY

CISS Security Series

Edited by
Naeem Salik

NUCLEAR PAKISTAN
SEEKING SECURITY & STABILITY

(CISS Security Series)

Edited by
Naeem Salik

THE UNIVERSITY OF LAHORE

Acknowledgements

This study is the outcome of invaluable contributions by the authors. It would also be appropriate to recognize the significant inputs starting with the conception of the project to review and editing of the manuscript by Colonel I. D. Hassan, the research coordinator at CISS. I would also like to mention the contributions made by Ms Maryam Zubair and Mr Sarmad Zia, research fellows at CISS by way of reading through various versions of the manuscript and assisting in editing and corrections.

ISBN 978-969-7813-00-1

Published by

University of Lahore, Defence Road, Lahore
Ph: (042) 32300865
Email: uolpp@uol.edu.pk

Nuclear Pakistan Seeking Security & Stability
(CISS Security Series)

Edited by
Naeem Salik

Copyright © 2018, Center for International Strategic Studies, Islamabad

All rights reserved
No part of this publication may be reproduced, stored in retrieval system, or transmitted, in any form or by any means (electronic or otherwise), without the prior written permission of the Center for International Strategic Studies, Islamabad (CISS)

Cover Design & Layout
Ahmad Ibraheem Sahil

CONTENTS

Foreword		vii
List of Acronyms		ix
Introduction		xv
1.	**Pakistan's Mastery of the Nuclear Fuel Cycle: Defying Technological Impediments** *Mansoor Ahmed*	01
2.	**Pakistan's Evolving Nuclear Doctrine** *Naeem Salik*	49
3.	**Pakistan's Nuclear Legislative Regime** *Ahmar Bilal Sufi*	67
4.	**Pakistan's Nuclear Command and Control** *Adil Sultan*	93
5.	**The Safety and Security Challenges and Response** *Naeem Salik*	121
6.	**Pakistan and the Non-Proliferation Regime** *Sannia Abdullah*	143
7.	**Pakistan and the IAEA** *Ali Sarwar Naqvi & Saima Aman Sial*	167
8.	**Pakistan's Prospective Force Posture in 2025** *Naeem Salik*	195
9.	**Contemporary Nuclear Debates** *Zafar Nawaz Jaspal*	223
	Conclusions and Analysis *Naeem Salik*	251
	Authors' Biographies	257
	Index	267

FOREWORD

Pakistan's nuclear program has been mired in controversies since its very inception. When Pakistan decided to pursue a military nuclear capability as an insurance against future threats to its security and integrity in the aftermath of the 1971 debacle, the Non-proliferation Treaty (NPT) had already entered into force in 1970. Fortunately, Pakistan had kept its options open by not acceding to the NPT in view of India's refusal to do so, and its pursuit of a nuclear weapons program was, therefore, not in violation of any international law or treaty obligations. However, its effort was seen to be in contravention to the fledgling international norms against further proliferation of nuclear weapons. Its plans to systematically build up its nuclear fuel cycle facilities were upended by India's first nuclear test in May 1974 that triggered the introduction of increasingly stringent controls over exports of sensitive materials and technologies especially to countries suspected of pursuing military nuclear programs. Pakistan's subsequent efforts to circumvent these restrictions and adopt unconventional means to acquire necessary materials and technology against the wishes of world powers created an image of illegitimacy that has refused to fade away. The revelations in 2004 of the activities of the AQ Khan network have further reinforced the negative view of Pakistan's nuclear enterprise.

Pakistan's intellectual response to hostile propaganda about its nuclear program has been rather weak and disjointed. It has only been in recent years that a few publications that project the Pakistani perspectives on the subject have appeared. However, while these publications provide adequate historical overview

of the program the contemporary issues and developments have not been adequately covered while some issues though directly associated with the nuclear program have not been addressed at all. Recognizing these deficiencies in the Pakistani nuclear narrative, the Center for International Strategic Studies (CISS), Islamabad, whose main area of interest is nuclear policy, has taken up the challenge to fill this void by coordinating the publication of an edited volume entitled "Nuclear Pakistan – Searching for Security and Stability."

Ambassador Ali Sarwar Naqvi
Executive Director, CISS
Islamabad, June 2017

LIST OF ACRONYMS

ADU	Ammonium Di-Uranate
AEARC	Atomic Energy Agricultural Research Centre
AEC	Atomic Energy Council
AEMC	Atomic Energy Minerals Centre
AEMC	Atomic Energy Medical Centre
AP	Additional Protocol
AQCS	Analytical Quality Control Services
BC-1	Baghalcur
BMR	Balancing Modernization and Rehabilitation
BoG	Board of Governors
BSS	Basic Safety Standards
C/S	Containment and Surveillance
C2	Command and Control
CANDU	Canada Deuterium Uranium
CAS	Chief of Air Staff
CD	Conference on Disarmament
CERN	European Organization of Nuclear Research
CISS	Center for International Strategic Studies
CJCSC	Chairman Joint Chief Of Staff Committee
CMD	Credible Minimum Deterrence
CNS	Chief of Naval Staff
COAS	Chief of Army Staff
CoE	Centre of Excellence

CPC	Chemical Production Complex
CPPNM	Convention on Physical Protection of Nuclear Material
CRP	Coordinated Research Project
CSD	Cold Start Doctrine
CSS	Committee on Safety Standards
CTBT	Comprehensive Nuclear Test Ban Treaty 1996
CWC	Chemical Weapons Convention
D&S	Disarmament and Safeguards
DCC	Development Control Committee
DG Khan	Dera Ghazi Khan
DIQ	Design Information Questionnaire
DPRK	Democratic People's Republic of Korea
DRDO	Defense Research and Development Organization
ECC	Employment Control Committee
ECNEC	Executive Committee of National Economic Council
EIF	Entry-into-Force
FAS	Federation of American Scientists
FMCT	Fissile Material Cut-off Treaty
GC	General Conference
GFMR	Global Fissile Material Report
GICNT	Global Initiative to Combat Nuclear Terrorism
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
ICBM	Intercontinental Ballistic Missiles
ICJ	International Court of Justice

ICSANT	International Convention on Suppression of Acts of Nuclear Terrorism
INES	International Nuclear Event Scale
IPFM	International Panel on Fissile Materials
IRRS	Integrated Regulatory Review Services
IRRT	International Regulatory Review Team
IRS	International Reporting System
ISI	Inter-Services Intelligence
ISIS	Institute of Science and International Security
ISR	Intelligence Surveillance Reconnaissance
KANUPP	Karachi Nuclear Power Plant
KINPOE	Karachi Institute of Power Engineering
KNFC	Kundian Nuclear Fuel Complex
KRL	Khan Research Laboratories
LEU	Low Enriched Uranium
MESA	Middle East and South Asia
MIRVs	Multiple Independently Targetable Re-Entry Vehicles
MPC&A	Material Protection Control and Accounting
MT	Management
NA	Nuclear Science & Applications
NAA	Neutron Activation Analysis
NCA	National Command Authority
NCNDT	National Centre for Non-destructive testing
NDT	Non-Destructive Testing Services
NESCOM	National Engineering and Scientific Commission

NFU	No First Use
NIAB	Nuclear Institute for Agriculture and Biology
NIBGE	National Institute for Biotechnology and Genetic Engineering
NISAS	National Institute of Safety and Security
NNWS	Non-Nuclear Weapons State
NPPs	Nuclear power plants
NPT	Non-proliferation Treaty
NRECC	Nuclear and Radiological Emergency Coordination Center
NS	Nuclear Safety & Security
NSA	National Security Advisor
NSAB	National Security Advisory Board
NSAP	National Nuclear Security Action Plan
NSG	Nuclear Suppliers Group
NSS	Nuclear Security Summit
NTI	Nuclear Threat Initiative
NE	Nuclear Energy
NUPG	Nuclear Power Generation
NUPP	Nuclear Power Projects
NURESC	Nuclear and Radiological Emergency Support Centre
NUSSC	Nuclear Safety Standards Committee
NWS	Nuclear Weapon States
OSART	Operational Safety Review Team
PAEC	Pakistan Atomic Energy Commission

PAROS	Prevention of Arms Race in Space
PCENS	Pakistan Centre of Excellence on Nuclear Security
PHWR	Pressurized Heavy Water Reactor
PIEAS	Pakistan Institute of Engineering and Applied Sciences
PINSTECH	Pakistan Institute of Nuclear Science and Technology
PM	Prime Minister
PNRA	Pakistan Nuclear Regulatory Authority
PRP	Personnel Reliability Program
PSA	Probabilistic Safety Analysis
PSI	Proliferation Security Initiative
RASSC	Radiation Safety Standards Committee
RCA	Regional Cooperation Agreement Project
RCF	Regulatory Cooperation Forum
RMI	Republic of Marshall Islands
SECDIV	Strategic Export Control Division
SES	Scientific and Engineering Services
SFCs	Strategic Force Commands
SG	Safeguards
SIPRI	Stockholm International Peace Research Institute
SLBMs	Submarine Launched Ballistic Missiles
SPD	Strategic Plans Division
START	Strategic Arms Reduction Treaty
SUPARCO	Space and Upper Atmosphere Research Commission
TC	Technical Cooperation
TCP	Technical Cooperation Program

TNWs	Tactical Nuclear Weapons
TRANSSC	Transport Safety Standards Committee
TUP	Technical Up-gradation Project
U02	Uranium dioxide
UF4	Uranium Tetra Fluoride
UF6	Uranium Hexafluoride
UN	United Nations
UNAEC	United Nations Atomic Energy Commission
UNGA	United Nations General Assembly
UNSC	United Nations Security Council
UNSCEAR	United Nations Scientific Committee on Effects of Atomic Radiations
WASSC	Waste Safety Standards Committee

INTRODUCTION

Pakistan's journey to attain the status of a nuclear weapons capable state has been long and arduous and its nuclear program has been facing hostile propaganda, diplomatic and political pressures, economic and military sanctions, threats of preventive strikes against its key nuclear installations and continued accusations and insinuations with regard to vulnerability of its nuclear assets to theft, sabotage or cessation of control by extremist elements. No other nuclear program in the world has faced such sustained hostility and no country has had to perpetually reassure the international community of the safety and security of its nuclear weapons and materials and viability of its custodial controls. Faced with the enormous amount of persistently hostile propaganda and resulting negative perceptions Pakistan's response has been inadequate and insignificant and only a small number of books projecting the Pakistani perspective have appeared so far. Similarly, number of quality research articles also fall far short of the requirement. Consequently, whereas the narratives showing

Pakistan in negative light have solidified, the Pakistani point of view has failed to gain a foothold. A lot of commendable work that Pakistan has undertaken post 1998 in terms of establishing institutionalized mechanisms to ensure effective command and control, safety and security, export and regulatory control regimes and enactment of nuclear specific legislation has unfortunately not been effectively disseminated either inside or outside the country. Keeping in view this serious shortcoming this book is an endeavor to spread the Pakistani narrative in a credible and objective manner with chapters being contributed by Pakistani scholars and experts.

Pakistan's nuclear program owes its inception to the 'Atoms for Peace Program' initiated by President Eisenhower in 1953 and it became one of the earliest beneficiaries of US assistance in the exploitation of peaceful uses of nuclear energy in fields such as medicine and agriculture and later in the production of electricity. However, the progress remained slow due to a combination of factors such as resource constraints, lack of infrastructure and more importantly lack of political support amongst the ruling elites.

During the 1960s when India was acquiring all the elements of a complete nuclear fuel cycle, without any international restrictions, ostensibly for peaceful purposes but with a clear intent to build an inherent weapons potential, Pakistan did not exploit this window of opportunity which was available before the signing and entry into force of the Non-proliferation Treaty (NPT) in 1968 and 1970 respectively. The only exception amongst Pakistani leadership was Mr Z.A. Bhutto who as Minister for Fuel and Power and later as the

Foreign Minister had kept a wary eye on India's burgeoning nuclear infrastructure and had exhorted President Ayub Khan to allow the acquisition of essential nuclear facilities. Bhutto was frustrated in his efforts by lack of interest on part of the President and active opposition by influential members of his cabinet especially the Finance Minister and Deputy Chairman of the Planning Commission. The military also did not evince any interest in nuclear technology since it felt confident of the ability of its forces which were better trained and equipped as compared to their Indian counterparts. However, the 1971 debacle made Pakistani security managers review their security environment and given the widening gap between the conventional forces besides India's growing nuclear capabilities the only rational course appeared to be the development of a nuclear weapons option. Thus began the most challenging project ever undertaken by Pakistani scientists and engineers in the face of apparently insurmountable odds and all kinds of technology denial arrangements put in place by the industrialized countries in the wake of India's maiden nuclear test in May 1974. By then the NPT was already in force and the international export controls regime was taking shape in the form of London Supplier's Group later re-designated as the Nuclear Supplier's Group (NSG).

The timing of Pakistan's initiation of its nuclear weapons program was not propitious as it appeared to defy the nascent international norms against further nuclear proliferation. Even worse was the timing of the Indian nuclear test which had misused nuclear technology acquired ostensibly for peaceful purposes and had spurred the international community into action to prevent further proliferation by tightening the export control arrangements and

using political, diplomatic and economic pressures and sanctions to deter new aspirants such as Pakistan. For Pakistan acquisition of nuclear capability had become a matter of survival and it procured the needed pieces of equipment exploiting the loopholes in the existing export control regime and bypassing hurdles. The ultimate success of the Pakistani nuclear enterprise thus caused embarrassment to the champions of non-proliferation and therefore they remain adamant in their refusal to grant any kind of legitimacy to Pakistan as a nuclear weapons capable state. The second reason for persistently negative perceptions of Pakistani nuclear program can be found in its characterization as the so called 'Islamic Bomb' and unjustifiably linking it with the security in the Middle East. Thirdly, in the post 9/11 security environment in and around Pakistan concerns have been continually raised about the vulnerability of Pakistan's nuclear safety and security without giving due consideration to the steps Pakistan has taken to bring up its nuclear security at par with the international standards and the human and financial resources it has assigned to this task.

Pakistan has put in place an institutionalized command and control system and comprehensive export control and regulatory regimes backed up by an elaborate nuclear legislative regime. Pakistan's policies towards the existing non-proliferation arrangements and the treaties and agreements being negotiated at multilateral fora have evolved overtime in the light of its bitter experience of being singled out for imposition of sanctions and denial of technology even for peaceful purposes. Pakistan has been a member of IAEA in good standing and has never been accused of violating its safeguards agreements with the IAEA. It has had a very extensive

and productive cooperative relationship with the IAEA.

In the past few years an erroneous narrative has been circulating in the international media, think tank reports and statements by some officials dubbing Pakistan's nuclear program as the 'fastest growing nuclear arsenal in the world' without sufficient evidence to support this contention. The emerging international trends in the nuclear arena do not inspire much confidence as both Russia and the US have embarked on modernization and qualitative improvement of their respective nuclear arsenals. This is especially worrisome in view of the fact that the START process between the two countries has also broken down. Additionally, advanced conventional technologies such as hypersonic missiles with a potential for targeting of opponents' nuclear arsenals have a considerable destabilizing potential alongside the emerging threat of Cyber-attacks against command, control and communications systems.

Given the existing and emerging threats on the international security scene Pakistan's nuclear capability has assumed a critical role in safeguarding the country's sovereignty, integrity and vital national interests especially when the situation across its Western frontiers remains fluid, unstable and hostile and provocative and threatening doctrines and postures are being employed by our Eastern neighbor. Pakistan does not seek regional dominance or international prestige through its nuclear assets and views these primarily as tools for seeking security and stability in its immediate neighborhood. In this backdrop, this study provides a comprehensive picture of Pakistan's struggle to achieve nuclear weapons capability, its doctrinal thinking, its custodial controls

and safety and security arrangements, nuclear specific laws that have been promulgated, its relationship with the existing non-proliferation regime and international bodies such as the IAEA, a survey of the contemporary nuclear debates and Pakistan's prospective nuclear posture.

This book is part of the vision of the Center for International Strategic Studies (CISS); Islamabad's to produce edited books on issues of immediate concern to Pakistan's national security and those that are likely to emerge in the foreseeable future. The objective is to provide a dispassionate and credible perspective to scholars and researchers interested in studying Pakistan's complex security matrix and to stimulate a healthy debate on such issues within the intelligentsia and think tank community to promote a better understanding of these issues. *Nuclear Pakistan: Seeking Security and Stability* is second in the series of such publications being undertaken by the CISS.

Dr. Naeem Salik

CHAPTER: 1

PAKISTAN'S MASTERY OF THE NUCLEAR FUEL CYCLE: DEFYING TECHNOLOGICAL CAPITULATION

Mansoor Ahmed

Pakistan's long road to nuclear capability was achieved through the development and completion of a nuclear fuel cycle infrastructure. This endeavor was the biggest challenge before the country's nuclear establishment, especially after the international community and the western supplier states placed restrictions on dual-use and civilian nuclear technology exports to countries which had neither accepted full-scope safeguards nor signed the Nuclear Non-proliferation Treaty. Yet this technology cartel only succeeded in marginally extending the time-frame for Pakistan's march to mastering the nuclear fuel cycle. In the wake of the cancellation of bilateral contracts with European supplier states and Canada for the supply of safeguarded fuel cycle facilities in the wake of India's nuclear test of 1974, the Pakistan Atomic

Energy Commission (PAEC) embarked on the path of completing the nuclear fuel cycle on its own and succeeded in establishing at least ten plants and facilities outside safeguards by 1980-81.[1] It was only because of Pakistan's success in acquiring complete mastery over the nuclear fuel cycle—from uranium prospection, processing, conversion, enrichment, fuel fabrication and heavy water production, (research, power and production reactor design, development and operations), and fuel reprocessing that enabled it to develop the enriched uranium and plutonium routes for the production of fissile material for nuclear weapons. However, this chapter only briefly traces how Pakistani scientists and engineers were able to take up the challenge of acquiring mastery over the front and back end of the nuclear fuel cycle in the face of international non-proliferation sanctions, acute resource constraints and a pressure to build this capability to match India's nuclear threat. However, this chapter does not discuss the establishment of the gas-centrifuge plant at Kahuta and the Khushab reactor project as Pakistan was not seeking international cooperation for their development—even though export controls continued to affect the acquisition of some vital materials and equipment during their construction.

Picking up the Pieces

Pakistan's nascent nuclear program experienced a fundamental transformation when the then President Zulfiqar Ali Bhutto promised the nation that he would pick up the pieces soon after the dismemberment of East Pakistan in December 1971. Within three weeks, he exhorted the Pakistan's best and the brightest—its scientists and engineers—assembled under a colorful tent

at Multan on January 20, 1972 to develop the nuclear option in the shortest possible time. He was a politician, unaware of the formidable technical, domestic, and international challenges that this undertaking would have to overcome. Nonetheless, Pakistan's nuclear enclave soon embarked on an arduous journey to acquire nuclear capability in which the mastery over the nuclear fuel cycle would prove to be the most significant milestone. When a new Pakistan emerged from the dismemberment of its Eastern wing in December 1971, the country only had a small civilian nuclear infrastructure comprising the Pakistan Institute of Nuclear Science and Technology (PINSTECH), the 137 MW Karachi Nuclear Power Plant, and the Atomic Energy Mineral Centre, Lahore. In 1972, PINSTECH which was still incomplete and its various laboratories and facilities were made operational only after being equipped with the necessary equipment and machines two years later. KANUPP was completed but not yet commissioned, and no nuclear fuel cycle facilities existed in the country.[2] Therefore, "The first task of PAEC was to prepare a nuclear plan, build the necessary infrastructure, and develop the required manpower to implement it."[3] A comprehensive roadmap for the development of a sustainable nuclear program was now needed that would give Pakistan the "nuclear option." Mr. Munir Ahmad Khan had taken over as chairman PAEC in March 1972 from Dr. I. H. Usmani and in May 1972, he presented a plan to President Bhutto for approval.[4] He recalled:

> Within two months of [the Multan meeting], we submitted a detailed nuclear plan to the President, which envisaged complete control of the nuclear fuel cycle, and building numerous plants and facilities for the generation and application of nuclear know-how. More importantly, the plan was approved within two hours. I remember,

> the President turned to the Finance Minister Mubashir Hasan, and said, 'I hereby abolish all the several committees dealing with Atomic Energy in various Ministries. You give him the money as he puts in a request.' And the PAEC was supposed to report directly to the Chief Executive. If that thing had not happened, we would have been under a Joint Secretary in the Ministry of Industries or Science and Technology. So these were immediate measures taken to give us the freedom we needed to act and the access we needed to the decision-makers in Pakistan.[5]

Once the 137 MWe Karachi Nuclear Power Plant (KANUPP) was commissioned in November 1972, Mr. Bhutto approved different fuel cycle projects including uranium mining, fabrication of nuclear fuel, reprocessing plant and related facilities. [6] Thereafter, the foremost priority for the PAEC was to complete the nuclear fuel cycle[7] and the late Dr. Muhammad Yunus played a very important role in the planning and launch of various fuel cycle projects, as head of PAEC's Directorate of Nuclear Fuels and Materials.[8] The three elements required to accomplish the task — Manpower, Materials and Money — were in short supply in 1972, recalls Dr. Ishfaq Ahmad. Of these, manpower was perhaps the biggest challenge[9] given that half the trained manpower painstakingly trained in the previous decade under Dr. I. H. Usmani and Prof. Abdus Salam were of Bengali origin and had opted to leave for Bangladesh. This left only a total of 283 trained personnel in PAEC, including all PhDs, engineers and technicians.[10] They were soon to face their first task of successfully commissioning the country's first nuclear power plant—KANUPP as the events of December 1971 had also prompted the Canadians working on the final stages of the CANDU type Pressurized Heavy Water Reactor (PHWR) to leave Pakistan.[11] But KANUPP had to be completed

and commissioned as it was built to supply electricity to Pakistan's largest metropolis, Karachi, and its successful completion and commissioning would symbolize the success or failure of Pakistan's nascent nuclear energy program. The entire KANUPP team worked tirelessly to have the plant commissioned on time and some of the Canadians were successfully brought back to help in the process.[12] In order to cater to the acute manpower shortage as KANUPP was being commissioned, the need for an in-house training infrastructure was acutely felt. The Karachi Nuclear Power Training Centre (KNPTC) was thus established in 1973, which would serve as the training ground for nuclear power plant engineers and technicians. It would later evolve into the Karachi Institute of Power Engineering (KINPOE).[13] KANUPP was finally inaugurated on November 28, 1972 by President Zulfiqar Ali Bhutto, Prof. Abdus Salam, chief scientific advisor to the President of Pakistan and Mr. Munir Ahmad Khan, Chairman PAEC.[14]

At the inauguration of KANUPP, President Bhutto made the first public speech on Pakistan's nuclear policy and re-affirmed his government's commitment to the development of the nuclear technology. He stated: "The inauguration of KANUPP is a historic occasion for Pakistan. It symbolizes our people's determination to keep pace with modern technology. We want to be part of this nuclear age and in harmony with the march of time. We believe that in order to accelerate the economic and social development of Pakistan, to overcome the poverty of our people, we must use the latest technology and techniques available to the modern epoch. Nuclear energy fits into this pattern. I well remember the struggle we had to go through to get KANUPP sanctioned and to launch other atomic energy activities in the country. The powerful

vested interests opposed it. If they had their way, we would not be inaugurating this nuclear plant today."[15] President Bhutto also addressed the Chairman PAEC, and spelled out his commitment to supporting the nuclear program:

> Since 1965, I have been in close touch with you and we have had many occasions to discuss how atomic energy can help in the development of the country. This is why soon after assuming this office, I not only placed the Atomic Energy Commission under my direct control but asked you to return to the country and serve the nation. I am glad that this Commission is on the move with a well-defined program for the future. I want this program implemented in the speediest manner. I believe that Pakistan's survival lies in using nuclear research, nuclear technology and nuclear power for the betterment of its people. The government will give the fullest support to the program of Atomic Energy Commission and this country will make the necessary resources available to bring the promise of atomic energy to the people of Pakistan at the earliest possible time. I want first class science in Pakistan because nothing less is acceptable. And I wish Pakistan to be increasingly self-reliant in all aspects of technology.[16]

While highlighting the salient features of Pakistan's nuclear policy, President Bhutto said, "Pakistan believes in using atomic energy for peaceful purposes and as an instrument for development and progress. We have placed our nuclear facilities under International Safeguards of the IAEA. We would like to see other countries in our region do the same." He also openly called for a South Asia free of nuclear weapons.[17]

The Smiling Buddha and Technology Denial

At 8.05 a.m. on the morning of May18, 1974, India carried out its first ever test of a nuclear device at the Pokhran test site in the Rajasthan desert, only about 50 miles from the Pakistani border. While Mr Bhutto pledged to the people of Pakistan that "we will never let Pakistan be a victim of nuclear blackmail,"[18] the Chairman PAEC stated that, "India's test had opened the floodgates for nuclear weapons and unless decisive action is taken, the membership of the nuclear club will not stop at six."[19] Prime Minister Z A Bhutto not only had an acute realization of this reality but also that "Pakistan had no choice but to acquire essential nuclear technology under safeguards, if possible, without it, if necessary, in order to neutralize India's nuclear edge."[20]

Pakistan also took up the matter at the IAEA Board of Governors on June 8, 1974 where one senior official of the IAEA told Munir Ahmad Khan, "Even though it was India which had carried out the nuclear explosion, it would be Pakistan which would be punished for that."[21] This would prove to be a prophetic remark in the years to come.

While most of the world powers stopped short of condemning India on its nuclear test, and some others sent their congratulations, the most severe reaction came from Canada. India had used a Canadian supplied CIRUS reactor for obtaining the plutonium used in its nuclear test of 1974 in violation of India's commitment and agreement with Canada whereby India had pledged not to use CIRUS for military purposes. While Canada cut off all nuclear cooperation with India, the same policy was abruptly and arbitrarily applied on Pakistan as well, even though Pakistan had

faithfully implemented all IAEA safeguards and honored bilateral agreements with Canada and other supplier countries. While India had a strong industrial base and a robust nuclear infrastructure, Pakistan had to face severe difficulties in operating KANUPP, which had been supplied by Canada and was under safeguards.[22] Alarmed by India's test, and anticipating a future Pakistani response, the industrialized countries led by the United States set up the London Suppliers Group or LSG in 1975 which prevented the transfer and export of all nuclear materials, technology and facilities to those countries which had not accepted full-scope safeguards on their nuclear programs and signed the NPT. By doing so, the LSG guidelines went one step ahead of the IAEA regulations which did ensure the continuity of nuclear cooperation between supplier and recipient states on all safeguarded facilities.[23]

Pakistan had signed an agreement with Canada in 1973 for the supply of a nuclear fuel fabrication plant, under IAEA safeguards. Following India's test, the shipment of this plant was actually stopped while the plant equipment and machinery was lying in port, ready to be shipped to Pakistan.[24] Under US pressure, West Germany also cancelled an agreement with Pakistan for the supply of a heavy water production plant which was also supposed to be under IAEA safeguards.[25] In the following years, France also unilaterally abrogated an agreement with Pakistan for the supply of a commercial fuel reprocessing plant, which was to be under IAEA safeguards and its supply to Pakistan had been approved by the IAEA Board of Governors in February, 1976. All this occurred because the supplier states, like Canada, France, West Germany and others had become members of the LSG, which stipulated the application of full-scope safeguards on all nuclear facilities

of the recipient state, whether foreign supplied or indigenous, in addition to complete adherence to the NPT. Therefore, after 1974, Canada insisted that Pakistan sign the NPT and place its entire nuclear program, which was at an early stage of development, under complete international safeguards and inspections. This was discriminatory since Pakistan, unlike India had not violated any international safeguards agreement, and therefore refused to accept this demand. Consequently, in December, 1976, Canada abruptly cut off the supply of nuclear fuel, heavy water and spare parts to KANUPP and also withdrew all technical support in the form of Canadian manpower from Pakistan, thus effectively punishing Pakistan for India's sins.[26] But all this placed Pakistan on the path of nuclear self-reliance and strengthened its resolve to develop nuclear capability in the face of sanctions on the supply of nuclear technology, even for purely peaceful purposes. As one PAEC scientist summed up this spirit:

> Seeking knowledge and technological advancement was not the exclusive domain of the West. They [the West] believe it is a matter of entitlement, privilege and exclusive domain. The developing world must be kept deprived from seeking knowledge and technological advancement. After centuries of exploitation, suppression and colonizing, they feel offended if we get the knowledge and utilize that experience for our motherland. This has nothing to do with the spread of nuclear technology but is a racist and apartheid attitude.[27]

Therefore, in the wake of India's nuclear test, "the political leadership in Pakistan realized that Pakistan had to face a de facto nuclear India alone, and it had no choice but to acquire essential nuclear technology under safeguards, if possible, without it, if necessary, in order to neutralize India's nuclear edge." [28]

Completing the Nuclear Fuel Cycle: With or Without Safeguards

Mastering the fuel cycle involved a two-pronged strategy of acquiring the necessary plants, facilities and equipment needed from foreign supplier countries, and simultaneously working on indigenous facilities. Therefore, prior to India's test of May 1974, Pakistan entered into several agreements with supplier countries for the acquisition of fuel cycle facilities, such as a nuclear fuel fabrication and a heavy water plant, and a nuclear fuel reprocessing plant, all under IAEA safeguards.[29] In 1973, the Chairman PAEC travelled to Canada to negotiate the purchase of the nuclear fuel fabrication plant for the Canadian supplied KANUPP.[30]

The know-how and expertise gained through the acquisition of foreign supplied facilities could then be used in building and applying the same in indigenous programs, both in the civil and military sides of the nuclear program. The logic behind acquiring safeguarded nuclear fuel cycle facilities was to have an infrastructure within Pakistan that could generate the know-how for and help train the hundreds of Pakistani scientists and engineers who would work in these facilities, while they were being set up within Pakistan. This could then be applied on other projects outside the scope of international safeguards to whatever nature of programs and projects the country may wish to follow, as per its security and technological needs.[31] Therefore Pakistan's underlying strategy was to acquire technology and know-how under safeguards and then develop the nuclear option independently: "The initial plan was not to divert or misuse foreign-supplied reactors and a reprocessing plant to produce nuclear-weapon fuel, but rather to use the know-how gained from this cooperation to indigenously produce parallel capabilities that could yield a bomb."[32] Besides

the acquisition of various materials, machines and equipment for completing the fuel cycle projects, PINSTECH played a key role in indigenous R&D which led to the success of all fuel cycle projects and was thus the primary research and design center of all nuclear fuel cycle activities in Pakistan.[33]

Uranium Prospection

In 1959, the Pakistan Atomic Energy Commission had discovered radioactivity in the Swalik Mountain Range in Dera Ghazi Khan (DG Khan) in the Punjab province. A 100 km belt had been identified for uranium prospection extending from areas of Rakhi, Baghalchur and Rajanpur as a result of drilling.[34] PAEC began uranium exploration and prospection in 1960, which continued till 1963. In 1970, a pilot plant for processing concentrated uranium ore or yellowcake with a capacity of 10000 lbs. per day was designed and fabricated by the scientists and engineers of the Atomic Energy Minerals Centre (AEMC), Lahore. AEMC was the first research establishment of PAEC set up by Dr. I. H. Usmani in 1961 and served as a multi-disciplinary research center for the first generation of scientists and engineers as PINSTECH was being completed. The AEMC at that time was headed by Dr. Ishfaq Ahmad and the pilot plant was designed and fabricated by Dr. Muhammad Shabbir. [35]

In pursuit of achieving self-reliance in the nuclear fuel cycle, the first step taken by PAEC after 1972 was to speed up exploration of uranium deposits and to refine the uranium that had been already discovered in the 1960s.[36] "Our first task was to find uranium in Pakistan and master the technology for mining and refining

of uranium and making it into pure oxide gas and metal and produce other nuclear minerals, which we needed," recalled the then Chairman PAEC.[37] Geological surveys were initiated in 1972 to explore mine-able deposits of uranium which were found in several locations in Pakistan, which included the Swalik Hills, west of Dera Ghazi Khan.[38] On December 27, 1973, it was announced that large uranium deposits had been discovered in the southern Punjab province.[39] Uranium exploration efforts continued in the early 1980s[40] and in 1983 additional deposits of uranium ore were discovered in Sind province and in the NWFP, in addition to the Sonmiani range which indicated the presence of 4 MT of heavy minerals including uranium. Uranium bearing regions were also discovered in the Eastern Potohar region, on both sides of the Indus River.[41] Uranium exploration work continued unabated in the following years as well. The government allocated a sum of US $ 1.5 million for a nuclear mineral survey and US $ 4.5 million for an ongoing uranium exploration project in Dera Ghazi Khan. Another milestone in uranium exploration was achieved in 1987 when the Solid State Nuclear Track Detection Laboratory of PINSTECH had fabricated Chromium Kf39, which is used in uranium exploration. By 1988, PINSTECH had developed a new technique used in uranium exploration and mining in Pakistan. This was most likely based on in-situ leaching for uranium mining.[42]

Uranium Processing and Conversion

Prior to the 1970s, Pakistan had almost no experience in mining uranium on an industrial scale. However, it was "a team of young engineers from AEMC" which conducted the requisite uranium

exploration and mining operations even as the skilled labor force was scarce, and "the drillers and miners trained were among an illiterate labor force available in the region."[43]

The need for developing indigenous capabilities in the front end of the fuel cycle—comprising uranium prospection, processing and conversion would become more acute after the Canadians abruptly cut off supplies of nuclear fuel for KANUPP. Pakistan also needed this capability to produce the feedstock for the indigenous uranium enrichment program. Dr. Muhammad Shabbir—the Project Director for Chemical Plants Complex recalled that, "PAEC started refining uranium where the Canadians and Australians stopped."[44] The mining of uranium in Pakistan was particularly challenging because the ore obtained was "relatively low grade and consisted of only a few kilograms of uranium per ton in contrast to uranium ore from Canada" which had a greater concentration of uranium per ton. Therefore, "Pakistan's uranium extraction plant had to be designed more carefully, in order to reduce impurities and extract more uranium."[45] This process was solely mastered by the manpower from AEMC coupled with the help of Pakistani industries and PAEC was able to complete its uranium ore concentrate (yellow cake) production plant by 1977—one year after Canada cut off supplies of natural uranium.[46]

In addition to the low-grade uranium deposits found in areas around Dera Ghazi Khan, Baghalchur, in developing indigenous capabilities for an uninterrupted supply of uranium, Pakistan by 1976 also faced restrictions in procuring technology and equipment. So to circumvent procurement bottlenecks due to restrictions, PAEC came up with a simple, yet very useful strategy

in which a Post Office Box Number (P.O. Box No. 1) was set up in DG Khan, for the BC-1 facility, through which tenders and advertisements were issued.[47] This equipment included supply of mineralogical equipment, drilling accessories, sulphuric acid resistant cast iron pipes, fittings for the sulphuric acid plant at 100 degrees centigrade, MS and GI Pipes, stainless steel containers, ball and roller bearings, portable air compressors and accessories, and other related items were acquired through open tenders through delivery at DG Khan.[48]

Although BC-I is a separate facility, it may be considered to be integrated with the Chemical Production Complex in terms of its functions and responsibilities. BC-1 consists of an ore storage mill; a ball-grinding mill; a sulphuric acid plant; a solvent extraction plant; and a tunnel drier. Almost all the units of the uranium refining plant were manufactured in Pakistan.[49]

In November, 1986, PAEC held an exhibition, "Atoms for Development Exhibition-1986", which highlighted its achievements in discovering uranium and its refinement at the uranium mill at DG Khan entirely through indigenous efforts.[50]

Uranium Conversion: The Chemical Plants Complex

Within a year of India's 1974 nuclear test and the impending technology denial which was soon to scuttle Pakistan's efforts to establish a nuclear fuel cycle through international cooperation and safeguards, PAEC began work on a dedicated Complex known as CPC or the Chemical Production Complex, located in the arid desert landscape of Southern Punjab province, close to

the town of Dera Ghazi Khan (D. G. Khan). Apart from security considerations, this site also abounded with the presence of large deposits of natural uranium. The CPC project would be completed within five years and would go on to produce two primary nuclear materials—the natural uranium dioxide for fabricating nuclear fuel for KANUPP and more importantly the production of natural uranium hexafluoride gas (UF6) which is the form in which uranium is enriched through gas centrifuges. The CPC would supply all the feed material for the centrifuge enrichment plant at Kahuta.[51]

Therefore, the establishment of the Chemical Production Complex (CPC) was from the very beginning a critical element of the front end of the nuclear fuel cycle leading up to the fabrication of indigenous nuclear fuel and was fundamental to the success of the uranium enrichment program. A former Member (Technical) PAEC Dr. Samar Mubarakmand thus emphasized the significance of the CPC project: "At least half the steps leading to the development of a nuclear device were completed and mastered in the two PAEC facilities located at BC-1 and CPC."[52]

Given that UF6 would only be used in a country's enrichment program, it was impossible for Pakistan to import any appreciable quantities of this nuclear material. So without a dedicated and indigenous UF6 production facility, the enrichment plant at Kahuta could never work at an industrial-scale or even a pilot-scale producing low or highly enriched uranium, except perhaps as a test-facility for testing the centrifuges.[53] Having a centrifuge plant without a UF6 production supply chain is like having an oil refinery without any crude oil—thus making both the UF6 and

the centrifuges integral to the success of the uranium enrichment cycle. The complexity of the uranium hexafluoride plant meant that it could not be procured off the shelf by Pakistan for the few companies around the world who could be of some help in building such a plant would surely know what its intended purpose would be. Therefore, it had to be built in Pakistan, by Pakistani scientists and engineers, in order to understand the challenges and master the technology involved in developing and running a hexafluoride production facility.[54] Dr. Muhammad Shabbir who headed the CPC for 17 years from its inception emphasized: "If there is no [uranium] hexafluoride, there cannot be any enrichment and producing hex is no child's play."[55] The CPC comprises seven independent chemical plants where UF6 is produced.[56]

1) Uranium Mill which extracts uranium in the form of yellow cake
2) A plant to refine yellow cake to produce Ammonium Di-uranate (ADU)
3) Conversion of ADU to Uranium Dioxide (UO2)
4) Plant to produce Hydrofluoric Acid
5) Plant to produce fluorine gas
6) Plant to convert UO2 to Uranium Tetra Fluoride (UF4)
7) Conversion of UF4 to Uranium Hexafluoride (UF6)

> Uranium hexafluoride gas or UF6 is produced through a long, intricate process using hazardous, toxic and radioactive materials. The most difficult part of the whole process is the production of highly volatile, dangerously toxic and extremely corrosive fluorine gas that require special electrodes and the production of hydrofluoric acid.[57]

The team working at CPC had to acquire complete mastery over vacuum welding technology to preclude any possibility of a potential leak that could be fatal for any human coming in contact with hydrofluoric acids and fluorides. Those working at CPC also had to prove their expertise in nuclear chemistry, especially fluorine chemistry and fluorine being the most reactive of all elements in the periodic table made it a formidable challenge for them.[58]

After initial refining at the uranium refining plant, uranium ore concentrate or yellow cake has to be converted into uranium dioxide. Then this is reacted with hydrogen fluoride, which involves the production of hydrofluoric acid and fluorine gas, to form uranium tetra-fluoride or UF4. Production of UF4 was therefore a major obstacle which was successfully addressed by Dr. Aminuddin Ahmed.[59] The UF4 thus obtained, is then reacted with fluorine gas to produce uranium hexafluoride gas or UF6. The PAEC team at CPC primarily consisted of Dr. Muhammad Yunus, Dr. Muhammad Shabbir, Dr. Aminuddin Ahmed, and Dr. N. A. Javed. The CPC project was supervised by Dr. Muhammad Younis who was then Director Fuels and Materials, PAEC, while the plant itself was managed and built under the direction of Dr. Muhammad Shabbir. "The CPC perhaps remained one of the best kept secrets of Pakistan's nuclear program, not only from the prying eyes of the satellites but also intelligence agencies on the ground, the international media and miraculously from the people of D.G. Khan itself."[60] The secrecy of CPC was kept even from high-ranking officials within Pakistan, such as Lt. General (Retd) Malik Ghulam Jilani Khan who while serving as Punjab Governor, was not given any information as to the exact nature

of the work being carried out at CPC, and Nawaz Sharif, who as Chief Minister of Punjab was denied access to the airstrip which was specifically built for CPC.[61]

While CPC was being developed in D. G. Khan, it was frequently visited by Munir Ahmad Khan. Revisiting Pakistan's front end fuel cycle efforts shortly after the 1998 nuclear tests, he recalled:

> Our first task was to find uranium in Pakistan and master the technology for mining and refining of uranium and making it into pure oxide (U02), gas (UF6) and metal (UF4) and produce other nuclear minerals, which we needed. Uranium metal was the first metal produced in Pakistan from indigenous ore. At that time we had not made even a ton of copper, or ton of steel, but we were able to produce, thanks to the efforts of PAEC scientists and engineers, a ton of uranium metal back in the 1970s. In D.G. Khan, we built a Complex, which perhaps is small by international standards, but is unique in the world, because it receives ore and sand and rocks, and ships out pure finished products of uranium [U02, UF4, and UF6], zirconium and other materials. Like PINSTECH, it is also the pride of Pakistan.[62]

The estimated annual production capacity of CPC is reportedly 200 tons of UF6.[63] For the enrichment program to succeed, it was essential that the UF6 produced must be of the highest purity and free of any impurities. Some of the impurities in UF6 such as molybdenum hexafluoride or MoF6 and other oxy-fluoride impurities in UF6 might condense and cause blockages in the valves and piping of the centrifuges cascades, thus causing the centrifuges to crash. These impurities normally appear at the stage of production of UF4 and if they are not identified and removed earlier, they can pass on into the centrifuge cascades unchecked.[64]

As was witnessed in Iran's nuclear program decades later, the inability to produce pure UF6 gas remains an important technical barrier to successful production of weapon-grade enriched uranium through the gas-centrifuges.[65]

In late 1979, as it was rumored that CPC was having some difficulties in the production of fluorine gas which was fundamental to the production of UF6. A team of PAEC scientists and engineers headed by Dr. Ishfaq Ahmad, then Member (Technical), and consisting of Dr. Samar Mubarakmand, and Pervez Butt were sent to CPC to help in addressing the problem. One of the plants supplied by the West German firm turned out to be faulty and needed replacement.[66] The issue was resolved by the PAEC team and the first kilogram of UF6 was produced at CPC on June 30, 1980. Reportedly under the influence of bureaucratic-politics within the nuclear establishment, General Zia had given Munir Ahmad Khan a 6-month deadline for the production of UF6. In one of the meetings during this crisis at CPC, "one senior official asked Munir Ahmad Khan to tell General Zia to wait for a few more weeks, and if PAEC failed by then, he could hang the scientists also." Zia had only hanged Bhutto a few months before. The six-month deadline was finally met and Dr. Ishfaq Ahmad was asked by Munir Ahmad Khan to personally go to Islamabad from Multan and tell General Zia that PAEC had succeeded. Zia dispatched General K.M. Arif and Ghulam Ishaq Khan to verify the production of UF6 at CPC. [67]

Fabricating Indigenous Nuclear Fuel

The history of producing indigenous nuclear fuel in Pakistan,

like so many other areas of the nuclear fuel cycle is a story of international discrimination, dishonoring of bilateral and international cooperation agreements, and denial of even peaceful and civilian nuclear technology. It is also a story of how Pakistani scientists, engineers and technicians stood up to nuclear apartheid practiced against Pakistan by the suppliers of nuclear technology in the world and indigenously built what many in the west believed Pakistan could never do.

When Pakistan signed a contract with Canada in 1965 for the supply of a 137 MW heavy water nuclear power reactor (KANUPP), Canada also offered a nuclear fuel plant, but at that time Pakistan did not to show any interest in availing this offer. KANUPP was completed with Canadian assistance and went into operation in November, 1972 and Canadian technical support continued till 1976. When in 1973 Pakistan tried to re-negotiate the supply of a nuclear fuel fabrication plant for KANUPP that was on offer in 1965, the Canadians initially had reservations that they may lose revenue from export of nuclear fuel which they were supplying to KANUPP and they had renewed proliferation concerns attached with the supply of such a plant which if supplied could give Pakistan an independent nuclear fuel fabrication capability and thereby make it self-sufficient in the nuclear fuel cycle.[68]

However, the President of Atomic Energy of Canada Ltd expressed his willingness to supply such a plant to Pakistan citing a similar supply to India. An agreement to this effect was signed in 1973 and Canada was to complete the delivery of the supply by 1975, and it was agreed that the IAEA safeguards on KANUPP could be extended to this plant as well. Canada and Pakistan were initially

to co-produce nuclear fuel in this plant for the first two years thereafter Pakistan would have to produce the fuel independently. But in the wake of India's nuclear test in May 1974, there was an abrupt shift in Canada's policy of nuclear cooperation with other countries, in view of its heightened non-proliferation concerns, which necessitated that the customer state must sign the NPT and open all its facilities to safeguards to qualify for nuclear technology cooperation and support. While this policy was the result of India's actions, Pakistan had to unjustifiably pay retribution for someone else's actions. [69]

Moreover, Canada was unhappy that Pakistan was acquiring reprocessing technology from France and in this context Canada abruptly halted the shipment of essential equipment for the nuclear fuel plant destined for Pakistan in late 1974, as Pakistan had refused to accede to the Canadian demands. Pakistan had already pledged to place this plant under the IAEA safeguards, so there seemed to be no justification for additional demands to be met by Pakistan. A year later, on 23 December, 1976, Canada unilaterally and suddenly cut off the supply of nuclear fuel, heavy water, spare parts and technical support to KANUPP and called back the Canadians working in KANUPP. Therefore, Pakistan had to develop an indigenous nuclear fuel capability and achieve self-reliance in this critical aspect of the nuclear fuel cycle. [70]

As mentioned above, PAEC had intensified uranium exploration efforts from 1972 onwards and had begun working on a uranium extraction and yellow cake production plant by 1976, which was completed within a year. Work on the uranium mining facility at Baghalcur(BC-1) was underway when Canada cut off supplies of

nuclear fuel and a full scale uranium refining plant was also set up to obtain pure uranium oxide for manufacture of nuclear fuel for KANUPP from the yellow cake. [71]

For the manufacture of indigenous nuclear fuel, a full-fledged nuclear fuel fabrication facility was established by PAEC at Kundian, on the banks of the Indus River, and adjacent to the Chashma site where a reprocessing plant was being built and a nuclear power reactor was planned but built many years later. The Kundian Nuclear Fuel Complex (KNFC) had an annual capacity of processing 24 MT of natural uranium oxide into fuel for KANUPP. This facility is not under IAEA safeguards. KNFC has a capacity of manufacturing 1500 fuel bundles for KANUPP.[72] A small zirconium oxide and Zircaloy- 4 production plant may also be located at KNFC where the natural uranium oxide is pressed into small pellets of very high density after being sealed in zircaloy cladding tubes, and then burnt as fuel in a nuclear reactor.[73]

Pakistani scientists and engineers were also faced with the challenges of not knowing the exact specifications of some of the critical materials and machinery used in building a fuel fabrication facility and the fuel itself, in addition to a lack of know how regarding certain manufacturing processes. Foreign support in this regard was also not forthcoming, so Pakistan's local industry was extensively engaged in this endeavor. Pakistan also had to indigenously produce the special materials needed to manufacture the zircaloy tubes into which the uranium oxide pellets are placed and burnt as fuel in a reactor. For this purpose, sands containing heavy amounts of zirconium were discovered on the beaches of Baluchistan and with the help of PINSTECH

scientists, a pilot plant was established by PAEC to separate the hafnium to obtain pure zirconium.[74]

While operating KANUPP, not a single fuel pellet produced by Pakistan has failed.[75] PAEC succeeded in producing the first nuclear fuel element for KANUPP in 1978, which was just two years since Canada cut-off supplies in 1976. KNFC started production in 1979 and on August 31, 1980, the Chairman PAEC announced in a press conference that Pakistan had achieved self-reliance in the manufacture of nuclear fuel from natural uranium and Pakistani scientists had built a nuclear fuel manufacturing plant at Chashma. According to him, fuel from the plant had been used in KANUPP during the past month to produce electricity for Karachi and the setting-up of the indigenous nuclear fuel production plant would save about $40 million in foreign exchange every year since Pakistan earlier had to depend on foreign suppliers for nuclear fuel. The first Pakistani fuel bundle was loaded on to the core of KANUPP in 1980 and within ten years, the entire core was loaded with Pakistani fuel bundles.[76]

PAEC also set up a test-reactor facility during the 1970s at KANUPP to test reactor fuel elements for quality assurance prior to use in the reactor.[77] A Mechanical Design & Development Division was established for manufacturing spare parts for KANUPP led by Engr. Parvez Butt besides a Control and Instrumentation and Applications Laboratory.[78] A 15 MT capacity heavy water up-gradation plant was also established to cater to the needs of the CANDU type power reactor[79] and a dedicated project for self-reliance in heavy water production was eventually built at the Khushab Nuclear Complex under the direction of

Dr. N. A. Javed. This project was developed from the mid-1980s onwards along with the 50 MW Khushab-1 production reactor and would cater to the needs of future production reactors at the same site.[80] The success in producing indigenous nuclear fuel was a milestone in the country's nuclear fuel cycle program. Munir Ahmad Khan recalled that, "I presented the first fuel element for KANUPP to the President of Pakistan two years after Canada cut off supplies, which, I think, is a significant achievement for any developing country"[81] and that the success at Kundian was the result of a team work, which became the hallmark of all Pakistani accomplishments in nuclear science and technology.[82] He also emphasized that, "Pakistan produced the first ton of purified uranium oxide and metal before it produced the first ton of copper or any other mineral using local ore and indigenously developed technologies." Further, "it taught Pakistani scientists and engineers about precision engineering, quality control, inspection, and design of complicated tools and machinery." [83] The experience gained through the indigenous manufacture of natural uranium oxide fuel (along with the production of uranium metal at CPC) would later be of great value for the setting up of a dedicated natural uranium metal fuel facility at KNFC for the indigenous production reactors at the Khushab Nuclear Complex.[84]

The embargos on the acquisition of fuel cycle facilities and cut off of vendor support for KANUPP served to strengthen Pakistan's determination to develop this capability. In this respect, a former Director-General of PINSTECH, Dr. N. M. Butt recalled:

> Although India initiated the nuclear weapon program by exploding the device in May 1974, on the one hand the continuity of operation of nuclear reactor at Karachi (the largest city of Pakistan with

> population of about 10 million) for electric supply to the grid was in danger (as Canada stopped the supply of CANDU Reactor) and on the other hand the whole nuclear program for peaceful purposes (educational, agriculture and nuclear medicine for public health) was greatly hampered due to the embargo policies by the West. The embargo alerted the nuclear scientists and engineers of Pakistan and they adopted the strategy of using their own expertise and skills to make things indigenously, which were previously purchased from the Western suppliers. The embargo by the West was therefore beneficial for developing in-house R & D in all high technology branches of nuclear technology. Consequently, in the next 5 years or so after the stopping of reactor fuel supply, by Canada, for the 137 MW Candu Reactor at KANUPP in Karachi, the reactor fuel to the quality specifications of the Canadian fuel was fabricated at the materials laboratories of PINSTECH using the indigenous exploration of uranium and by early 1980's on this design a uranium-fuel factory was established at Kundian and by late 1980's the home made fuel was already being used in this reactor. Thus from 1988 all the fuel charge of the reactor was homemade. Since then, the reactor, which the Canadians thought would close down within a year of the fuel-embargo, is being operated successfully till today with homemade fuel. This fuel fabrication technology gave the scientists and engineers a confidence to acquire further expertise in the area of nuclear technology. So, the embargo policy of the West in fact made Pakistan more nuclear capable rather than hindering its capability.[85]

A 1985 issue of the journal of Pakistan Atomic Energy Commission (PAEC) stated that Pakistan had joined the small group of countries that explore and mine their own uranium, as well as refine and upgrade it to the required specifications, fabricate it as fuel, and finally burn it in a commercial power reactor to produce electricity. It further stated that, "backed by extensive uranium

exploration and mining, the fabrication of safe and satisfactory fuel bundles for the Karachi nuclear power plant has won for Pakistan, the distinction of mastering the technology of the front end of the nuclear fuel cycle." [86]

Thus, by manufacturing indigenous nuclear fuel, Pakistan had successfully mastered the front end of the nuclear fuel cycle. By 1980, the Kundian Nuclear Fuel Complex, the Baghalchur-I uranium mining and milling facility and the Chemical Production Complex were ready and producing sufficient amounts of high purity yellow cake, uranium hexafluoride gas, uranium metal, uranium oxide and indigenously manufactured nuclear fuel for KANUPP. The PAEC scientists and engineers had accomplished all this in just five years, beginning in 1975.[87]

Completing the Back End of the Fuel Cycle

The detailed nuclear plan presented to President Bhutto in May 1972 had called for the complete control of the nuclear fuel cycle which included the acquisition and development of reprocessing plants—with or without safeguards.[88] While he was still at the IAEA, Munir Ahmad Khan along with Dr. Abdus Salam had prepared "a proposal for the establishment of a nuclear fuel reprocessing plant in Pakistan in [1967] without safeguards and at a nominal cost," which was deferred by President Ayub Khan on economic grounds.[89] PAEC under Dr. I.H. Usmani also considered the matter and proposed several fuel cycle projects which could not secure the necessary financial and political support. A Planning Commission document, from October 1969, 'Evaluation Report on the Karachi Nuclear Power Plant',

stated that the Executive Committee of the National Economic Council (ECNEC) had approved a plan for a fuel fabrication plant for KANUPP and PAEC had submitted proposals for setting up of a heavy water plant and a plutonium extraction plant with a proposed capacity of 100 Th.M./yr.[90] This also failed to secure the requisite political support. Therefore, in the wake of the shift in the scope and direction of the nuclear program in 1972, it was decided to again explore the option of acquiring reprocessing technology from France. The French were also eager to make profits from nuclear commerce, and were more than willing to supply not only reprocessing technology but also nuclear power reactors to third world countries.[91] Spent fuel reprocessing and plutonium extraction through the solvent extraction method was specialized by a French firm, Saint-Gobain Technique Nouvelle or SGN, and this was the firm PAEC turned to in its quest for obtaining reprocessing know-how.[92] For Pakistan, the French option may also have been promising enough since the French had not yet signed the NPT, and it was therefore conceivable that France would not insist on safeguards on plants and facilities it would sell to and help build in other countries like Pakistan. [93]

Pakistan wanted to utilize the cooperation extended by France only for reprocessing know-how, but also for training of Pakistani manpower that would enable them to master the back end of the fuel cycle. A viable nuclear fuel cycle development program coupled with a commercial-scale reprocessing project could only make economic sense and thereby create its own justification if Pakistan would have a corresponding nuclear power program. "To build a case for nuclear power, the IAEA was invited to carry out a comprehensive survey of the long-term needs of nuclear

power in Pakistan. The report made a strong case for nuclear energy in the power economy of Pakistan."[94] The PAEC-IAEA joint study for nuclear power in Pakistan envisaged that Pakistan would require eight 600 MW nuclear power plants between 1982 and 1990, nine 600 MW and seven 800 MW nuclear power plants between 1990 and 2000. This would result in a 25-year plan for building 24 nuclear power reactors in an integrated nuclear complex for acquiring energy independence. As part of this plan, in the first 12 years, four big projects were to be launched, and the 600 MW Chashma nuclear power project was the first one of its kind.[95] Therefore, "based on the recommendations of the IAEA report, it was decided to establish a Nuclear Complex at Chashma consisting of not only power reactors but also fuel fabrication and reprocessing, waste-handling and other supporting facilities. The size of the nuclear unit chosen was 600 MWe, which was becoming the standard unit at that time." [96]

This nuclear power plan was announced by Pakistan's Ambassador to the United Nations in 1976. He also said that other fuel cycle facilities like heavy water plant, fuel fabrication and reprocessing facilities would also be set up as part of the overall nuclear power plan.[97]

Therefore, PAEC and SGN signed two separate agreements for building an industrial-scale reprocessing plant at Chashma, in south-western part of Punjab province, with a reported capacity of reprocessing 100 tons of used reactor fuel. The first contract in this regard was signed in March 1973, which was for the "basic design" of the plant, while the second one, for "detailed design" and actual construction of the plant was signed between PAEC and SGN on

18 October 1974. As per the second contract, SGN promised to not only provide blueprints, designs and specifications, but also procuring equipment from suppliers and putting the plant into operation. SGN and the French contractors were expecting profits to the tune of US 8-10 $ million and US 45 $ million respectively. The French government also hoped to secure orders for at least three to four 600 MW power reactors, Mirage fighter-bombers and other hardware from Pakistan and the Arab states. [98]

Questions were raised as to the economic and industrial justification for a 100 tons /yr capacity reprocessing plant, and proliferation concerns came from all quarters, especially when the only reactor operating in Pakistan was the 137 MW CANDU type KANUPP reactor. The French Atomic Energy Commission was closely involved with the negotiations for the plant with Pakistan from the very beginning, but they too did not want to be seen as ones who were proliferating highly sensitive nuclear technology that could yield plutonium for a whole arsenal of nuclear bombs to Pakistan. They therefore, first entered into negotiations with Pakistan for mutually acceptable safeguards, but later under American influence began to ask for multilateral controls and international safeguards of the IAEA for the Chashma plant.[99]

Pakistan's position was simple. It wanted to harness nuclear technology for generating nuclear power for economic development and meeting its projected energy needs, and the reprocessing plant would give Pakistan the capability to produce nuclear fuel for their nuclear power program.[100] In 1976, PAEC said it planned to build eight nuclear power plants in the coming years, "that would give a technical-economic rationale to the

reprocessing plant." [101]

This was the justification for the acquisition of a 100- Th.M./yr capacity reprocessing plant, and this logic was at least understood by SGN.[102] KANUPP's annual fuel discharge was already going to consume one-fifth of the commercial-scale reprocessing plant's design capacity[103] which would have been barely sufficient to handle all the spent fuel from three to four medium sized power reactors. Nonetheless, nuclear power was in vogue at that time and the West Germans and Italians were also offering reprocessing technology which would be a logical part of planned sales of a number of medium and large nuclear power reactors to countries like Brazil for example.[104] Iran under the Shah also had similarly ambitious plans for setting up twenty power reactors under safeguards.[105] Therefore, Pakistan was not doing anything that other developing countries were not doing—planning to acquire nuclear technology for civilian purposes, with a clear economic rationale for nuclear power generation, and in doing so also acquiring the high technology nuclear reprocessing know-how as a spinoff.

When the French government asked for multilateral controls by IAEA for the Chashma facility, Munir Khan continued to remain non-committal and asked for the safeguards question to be deferred till the plant was either complete or had begun operations. Anticipating the writing on the wall, the Chairman PAEC argued with Prime Minister Bhutto in November not to agree to increasingly unreasonable French demands. He anticipated that France under U.S. influence would force Pakistan to agree to restrictions on the technology which was already in

the public domain and might cancel the contract once Pakistan had signed the agreement. In this way, Pakistan would be left with the obligations without the benefits for which it had paid. Given that SGN had already transferred 95% of the design information before the contract agreement was finalized, Munir Ahmad Khan maintained that Pakistan could complete the plant on its own and therefore it was unwise to proceed with the contract agreement under French pressure.[106] However, the Chashma reprocessing plant contract had become the symbol of Bhutto's nuclear ambitions and had assumed a central position in his domestic political standing. He was determined to proceed with finalizing the deal for the reprocessing plant despite seemingly discriminatory and Pakistan-specific restrictions being imposed by the supplier. The negotiations on safeguards continued throughout 1975 between Pakistan and the IAEA and the safeguards agreement was reached between the IAEA, France and Pakistan, and the IAEA gave its final nod in March 1976.[107] The Chashma facility would now be under full IAEA inspection and safeguards, and Pakistan pledged not to use it for manufacturing of any nuclear explosive device or any other military purpose. Pakistan was also made to agree that it won't build any other plant or facility based on the design information transferred under the Chashma reprocessing plant contract.

Even as protracted negotiations over safeguards were proceeding, the French firm SGN continued to work on the reprocessing plant and the French government expressed concern that once Pakistan had obtained the detailed designs, it would need little outside help to complete the plant indigenously.[108] Bhutto himself contributed to exacerbating international concerns through his press statements

and rhetoric during his visits to Europe and Canada.[109] By the time the American pressure on the French government forced it to back out of the contract in August 1978; SGN had transferred 95 percent of all the detailed engineering designs and drawings for building the reprocessing plant to PAEC, "including the plans for the chopping machine.[110]

In the wake of India's nuclear test of May 1974, in which it had used the Canadian supplied CIRUS reactor, whose heavy water had been supplied by the United States, the American policy towards the sale of nuclear technology underwent a fundamental change. The Indian test and the prospect of nuclear proliferation in the world as highlighted in the Wohlstetter Report forced the United States to take the lead in stopping the spread of nuclear technology from the nuclear haves to the have-nots.[111] Therefore, under American influence, the French offered Pakistan a change in the design of the reprocessing plant, which would yield mixed-oxide fuel, but not plutonium. Munir Khan on his part offered another modification, which would in the end yield plutonium, as Pakistan had no reactors or had no prospect of acquiring or building any breeder reactors that would use this mixed-oxide fuel. Agha Shahi, insisted that since Pakistan had placed the facility under full IAEA safeguards, it would not accept any modifications to the original tripartite agreement. By the fall of 1977, the French government took over SGN and thus effectively was able to press Pakistan directly to give in to their new demands. The IAEA safeguards did help Pakistan keep SGN committed to building the design of the reprocessing plant, and this was the critical know-how that PAEC was able to acquire even though the contract was ultimately cancelled.[112]

Nevertheless, from the time that the high-profile Chashma reprocessing contract was signed in October 1974, which incidentally is precisely the time around which PAEC launched the uranium enrichment program, till the cancellation of the contract in August 1978, the Kahuta uranium enrichment project along with the fuel cycle facilities comprising the uranium processing, conversion and nuclear fuel fabrication facilities, and the New Laboratories pilot reprocessing plant, had all been successfully launched and were nearing completion, in addition to the ongoing bomb design and development projects in the PAEC. The Chashma deal therefore served to act as a decoy for the establishment of the indigenous nuclear infrastructure for the strategic program that Pakistan needed to develop a nuclear capability. With the cancellation of the Chashma reprocessing plant contract, the 600 MW Chashma nuclear power project also fell victim to domestic and international controversy. The 600 MWe Chashma nuclear power project was approved by the National Economic Council in July 1973, while the ECNEC gave its formal approval to the project in March 1976. Tenders were to be issued in 1977 but the change in the government effectively shelved the project.[113] Not only this, the entire nuclear power plan which was dependent upon international cooperation became a victim of the new international non-proliferation sanctions for countries outside the NPT.

The Chashma plant had evoked a lot of controversy, both in Pakistan and abroad. Critics at home questioned the utility of this reprocessing facility for the nuclear weapons program when it was under full-scope IAEA safeguards, while others outside Pakistan expressed doubts about the efficacy of safeguards on

a plant with a reprocessing capacity of 100 tons/yr. Another contentious issue associated with the Chashma facility was that the only source of irradiated or spent nuclear fuel that could be reprocessed at this plant was from the 137 MW Karachi Nuclear Power Plant (KANUPP), which was also under IAEA safeguards. So had Pakistan been able to acquire Chashma, with or without safeguards, would PAEC then violate international safeguards agreements applicable to KANUPP and divert spent fuel from there to be reprocessed at Chashma?

Theoretically at least, this was a possibility, as KANUPP's spent fuel, when reprocessed, could easily have provided enough plutonium for several atomic bombs straightaway, in case of a national emergency or a critical threat to national security. According to a de-classified 1978 CIA Analysis, KANUPP could produce between 132 and 264 pounds of reactor or weapons-grade plutonium, depending on how the reactor was optimized for operation. Also by the time this report was released, KANUPP had already produced enough reactor-grade plutonium for thirty to forty weapons.[114]

Acutely aware of the consequences of violating international safeguards and following a policy of nuclear responsibility, Pakistan as a matter of policy never planned or illegally diverted any spent fuel from either KANUPP or any other safeguarded facility, such as the 5 MW PARR-1. Nor was the Chashma reprocessing plant intended for plutonium extraction for the weapons program. Whereas the basic philosophy underlying the acquisition of the much maligned Chashma reprocessing plant was back-end fuel cycle technology, Pakistan was determined to develop it by

whatever means. At the height of the international storm over the reprocessing issue, Pakistan's permanent representative to the United Nations exemplified Pakistan's resolve to defy international restrictions on nuclear technology. He stated that, "attempts to monopolize nuclear technology and to stop its transfer were bound to be discriminatory, and they are also unworkable for the reason that a country like Pakistan is not incapable of fabricating a fuel reprocessing plant."[115] In another statement in May 1976 at a symposium on nuclear energy, he declared that "his country would never accept technological capitulation."[116] In a warning that would later prove to be prophetic in Pakistan's case, he added that:

> developing countries, such as Pakistan feel that what is required, to restrain proliferation, is the elimination of nuclear weapons altogether, and not the withholding of essential nuclear technology from a greater portion of the world's population. If this knowhow is withheld from the Third World countries, they will, sooner or later, acquire it on their own; and then, what is more dangerous, they will be free to utilize it without any safeguards or international pressure.[117]

Even though PAEC continued to seek political and financial support for completing the Chashma reprocessing plant on its own, following the French cancellation of the contract in 1978, Gen. Zia's advisors refused to sanction funds for the purpose and to acquire the 600 MWe nuclear power plant for the Chashma Nuclear Complex from France.[118] It was only two decades later after the formation of the National Command Authority and through its Secretariat at the Strategic Plans Division that necessary funds were made available to complete and commission the abandoned

Chashma reprocessing plant.[119] For producing plutonium by reprocessing spent fuel in the 1970s however, Munir Ahmad Khan had launched a parallel project outside safeguards in 1973, which was the New Labs pilot-scale reprocessing plant.[120]

New Laboratories

While negotiations for the Chashma facility were being carried out, Pakistan had begun work in parallel on a secret pilot-scale reprocessing facility, although being one-tenth of the size of the planned Chashma plant (10 tHM/yr) with an annual capacity to separate 10-20 kg of plutonium. When completed it could reprocess enough weapons grade plutonium for one to three bombs each year. [121] This facility that PAEC was building to reprocess spent fuel and produce plutonium, as nuclear fuel for the bomb program was New Laboratories, better known as New Labs. It was built in the vicinity of PINSTECH and was not under any IAEA safeguards. By 1971, the UKAEA had completed a design for a lab-scale reprocessing facility with an annual production capacity of only 360 grams of plutonium, and the British design did not allow for any expansion, nor did the UKAEA agree to PAEC's request for a much larger facility. Therefore, when Munir Ahmad Khan began work on the secret reprocessing project that came to be known as New Labs, he opted for a Belgian design in a separate building that allowed for expansion, and the Belgians did not bother to demand any safeguards whatsoever. Munir Khan was of the view that it would be difficult for PAEC to upgrade an already downgraded laboratory scale facility[122] and probably he may have anticipated that the UKAEA and thereby the British, unlike the Belgians, would surely ask for IAEA safeguards on any

new up-scaled design for the reprocessing project. [123]

Therefore, PAEC contacted the Belgian firm Belgonuclaire for preparing the design of a pilot-scale reprocessing facility. The Belgians were to prepare the overall design of the new building as well as a fuel re-fabrication laboratory for New Labs, while the French firm SGN, the world leaders in reprocessing technology and primary contractor for the Chashma reprocessing plant were to prepare the engineering design for the reprocessing plant itself.[124] The tripartite agreement between Pakistan, France and IAEA for the Chashma reprocessing facility, finalized in the spring of 1976,[125] did not extend to the pilot reprocessing facility New Labs which pre-dated the Chashma reprocessing plant contract.[126] New Labs was completed by 1981 and cold commissioning campaigns were carried out in 1987 using insignificant and very small quantities of spent fuel from KANUPP under the exemption clause of the IAEA's safeguards agreement.[127] But Pakistan refrained from commissioning this unsafeguarded reprocessing plant until the safeguards-free spent fuel became available for reprocessing from the indigenous plutonium production Khushab-1 heavy water reactor in 1999-2000.[128]

Self-Reliance in Nuclear Power

Pakistan continued to face restrictions on the acquisition of nuclear power reactors throughout the 1980s which effectively scuttled growth of its nuclear energy program until it reached a comprehensive civil nuclear cooperation agreement with China. Signed on September 15, 1986 between the two foreign ministers—in the presence of the then Chinese Prime Minister, CNNC

officials and Chairman PAEC, it provided a holistic framework for securing sustained Chinese support in the promotion of the peaceful uses of atomic energy under IAEA safeguards.[129] In 1989, China supplied a 27 KW Miniature Neutron Source Reactor in November 1989 known as Pakistan Atomic Research Reactor-2 which was installed at PINSTECH[130] and by 1991, the PARR-1 reactor was upgraded from 5MW to 10MW.[131] It was also converted to run on 20 % Low Enriched Uranium (LEU) fuel instead of the HEU fuel. This was achieved by indigenous efforts of PINSTECH manpower which implied the complete overhaul and re-designing of the reactor.[132]

Pakistan and China reached an agreement in November 1989[133] (contract signed in December 1991) for the supply of a 300 MWe (Qinshan type PWR) nuclear power plant at Chashma under IAEA safeguards.[134] This paved the way for the establishment of three additional PWRs which have since been established at the Chashma Nuclear Power Complex. Therefore, the Sino-Pak civil cooperation agreement finalized between 1986 and 1989 effectively broke an international embargo on civil nuclear cooperation with Pakistan and ushered in a new era in South-South cooperation in nuclear energy. China and Pakistan signed the contract for the Chashma Nuclear Power Plant-1 or CHASNUPP only 16 days after China's Qinshan reactor went into operation.[135] The CHASNUPP-1 or C-1 agreement also covered a significant technology transfer to PAEC and training of its manpower. Unlike KANUPP, when PAEC only sent 47 scientists and engineers for training to Canada, the CHASNUPP-1 deal opened the way for PAEC to send hundreds of its scientists and engineers to China for training in commercial nuclear reactor technology.[136] Moreover, PAEC also got the

opportunity to involve its manpower in the "design, construction, manufacture, commissioning and operation of the plant."[137]

International embargos on civil nuclear cooperation increased the need for developing indigenous nuclear design and engineering capability—which would also contribute in the establishment of four indigenous plutonium production heavy water reactors at the Khushab Nuclear Complex. Consequently, in 1984, a new Scientific and Engineering Services (SES) Directorate—headed by Engr. Parvez Butt, was established in PAEC by merging Directorate of Industrial Liaison and KANUPP's Design &Development division.[138] At exactly the same time when PAEC launched work on the 50 MW production reactor and heavy water plant at the Khushab Nuclear Complex in 1986, the Chairman PAEC obtained Prime Minister Junejo's approval in January 1987 for a long-term strategic plan to achieve self-reliance in nuclear power.[139] This called for the establishment of indigenous design, precision engineering and fabrication facilities which were commissioned during the 1990s. These include a Seamless Tube Plant at Kundian; the Heavy Mechanical Complex-3, Taxila; and the National Center for Non-Destructive Testing, and Pakistan Welding Institute and other Nuclear Equipment Workshops. The HMC-3 project has also exported equipment worth millions of dollars to the European Organization of Nuclear Research (CERN), Switzerland.[140] These infrastructure projects have enabled Pakistan to expand the Khushab Complex from one 50 MW production reactor commissioned in 1998 to three more by 2016. The availability of plutonium has allowed for the miniaturization of nuclear warheads suitable for delivery by short-range ballistic and cruise missiles and facilitated the development of battlefield

or tactical nuclear weapons.[141]

CONCLUSION

Pakistan's mastery over the nuclear fuel cycle was arguably the greatest accomplishment in the country's nuclear journey. Yet the path to this goal was littered with obstacles and unforeseen challenges, which were successfully overcome only due to the consistent support given by successive governments, effective planning of the PAEC leadership and project-directors, and above all the dedication and ingenuity of hundreds of Pakistani scientists and engineers who worked in over twenty laboratories and projects for more than two decades. The motivation and determination that proved to be critical to sustaining this effort was to defy technological apartheid. This was summed up by the then Chairman PAEC in July 1977 in a statement over the impending cancellation of the Franco-Pakistan reprocessing plant contract: "Pakistan is resolved to go ahead with the reprocessing plant, the construction of which has become a national commitment. Recent attempts to pressurize Pakistan to abandon the deal only served to strengthen our determination to proceed speedily with our peaceful nuclear program as announced by the Prime Minister in his statements before the National Assembly. The proposed reprocessing plant is being built under strict international safeguards, making it impossible for using it for purposes other than peaceful. The need and relevance of this plant to our requirements is well known to countries opposed to Pakistan's acquisition of the plant. The real issue, however, is to withhold essential modern technology from us. A technologically advanced Pakistan does not seem to fit into their scheme of things." [142] Even

as Pakistan has come a long way since then, yet the international attitude of neo-nuclear apartheid[143]—this time exemplified by the politics over the membership of the Nuclear Suppliers Group and the unprecedented waiver accorded to India without any NPT obligations—remains unchanged. So does Pakistan's commitment to protect and advance its strategic program and develop nuclear technology for socio-economic progress.

Notes

[1]For a detailed account of the development of Pakistan's nuclear fuel cycle, see Feroz Hassan Khan, *Eating Grass: The Making of the Pakistani Bomb* (Palo Alto, C.A.: Stanford University Press, 2012); Naeem Salik, *The Genesis of South Asian Nuclear Deterrence* (Karachi: Oxford University Press, 2009); Shahid-ur-Rehman, *Long Road to Chaghi,* (Islamabad: Print Wise Publications, 1999); and Weismann and Krosney, *The Islamic Bomb,* (New York: Times Books, 1981).

[2]Feroz Hassan Khan, *Eating Grass: The Making of the Pakistani Bomb* (Palo Alto, C.A.: Stanford University Press, 2012), p. 91.

[3]Munir Ahmad Khan, "Development and Significance of Pakistan's Nuclear Capability," in *Pakistan: Founders' Aspirations and Today's Realities,* ed. Hafeez Malik, (Karachi: Oxford University Press, 2001) p. 153.

[4]Munir Ahmad Khan, (Chairman PAEC 1972-1991), Speech delivered at the Chaghi Medal Award Ceremony, Pakistan Nuclear Society, PINSTECH Auditorium, Islamabad, March 20, 1999.

[5]Ibid.

[6]Munir Ahmad Khan, "Bhutto and nuclear program of Pakistan", *The Muslim* (Islamabad), April 4, 1995.

[7]Shahid-ur-Rehman, *Long Road to Chaghi,* (Islamabad: Print Wise Publications, 1999), p.29.

[8]Ibid, p. 41.

[9]*Eating Grass,* p. 91.

[10]Ibid; Chaghi Medal Award Ceremony Speech.

[11]*Eating Grass*, pp. 107-108.

[12]Ibid.

[13]*Eating Grass*, pp. 107-108; Mian Abdul Ghafoor, "KANUPP: A Historical Perspective," *Pak Atom* (September/October 1996), p. 4.

[14]Ibid.

[15]Ibid, p. 108; PAEC Special Supplement Publication on KANUPP's Inauguration, (November 1972).

[16]Ibid, pp. 108-109.

[17]Ibid.

[18]Zulfiqar Ali Bhutto's Press Conference, May 19, 1974, Lahore; *The Pakistan Times* (Lahore) May 20, 1974.

[19]Central Intelligence Agency, "Bhutto Seeks Nuclear Policy Assurances" *National Intelligence Daily*, May 24, 1974.

[20]Ibid.

[21]Munir Ahmad Khan, "Nuclearization of South Asia and its Regional and Global Implications" *Regional Studies,* (Islamabad) Vol. 26, No. 4 (Autumn1998);*Eating Grass*, op. cit., p. 100.

[22]Ibid.

[23]Ibid.

[24]Ibid.

[25]Ibid.

[26]Ibid; Milton R. Benjamin, "Pakistan Says France Killing Controversial Nuclear Deal; Pakistan Says France Killing Nuclear Deal," *Washington Post*, August 24, 1978; "Development and Significance of Pakistan's Nuclear Capability," pp. 155-156.

[27]*Eating Grass*, op. cit., p. 110.

[28]"Development and Significance of Pakistan's Nuclear Capability," p. 155.

[29]"Development and Significance of Pakistan's Nuclear Capability," p. 153.

[30]Munir Ahmad Khan, "How Pakistan Made Nuclear Fuel," *The Nation* (Islamabad), February 7, 1998.

[31]George Perkovich, "Could Anything Be Done to Stop Them? Lessons from Pakistan" The Nonproliferation Policy Education Center, Washington. D.C. July 26, 2006. http://www.npolicy.org/article_file/Could_Anything_Be_Done_To_Stop_Them-Lessons_from_Pakistan.pdf

[32]Ibid.

[33]*Eating Grass*, p. 106; Also see I. H. Qureshi, "Development of Physical Sciences

Program at PINSTECH," Nucleus Vol. 42, No. 1-2 (2005), pp. 41-47.

[34]*Long Road to Chaghi*, p. 69.

[35]Ibid, pp. 69-70.

[36]Dr. Samar Mubarakmand, "A Science Odyssey: Pakistan's Nuclear Emergence," Speech delivered at the Khwarzimic Science Society, Centre of Excellence in Solid State Physics, Punjab University, Lahore, November 30, 1998.

[37]"Chaghi Medal Award Ceremony Speech." Also see Muhammad Mansoor, "Nuclear Minerals in Pakistan," *Nucleus*, Vol 42, No. 1-2 (2005), pp. 73-83.

[38]"How Pakistan Made Nuclear Fuel."

[39]Information Bank Abstracts, *New York Times*, 27 December 1973

[40]"Pakistan," Mining Annual Review, June 1982, Countries, Far East, Pg. 407; in Lexis-Nexis Academic Universe, June 1982.

[41]Ibid.

[42]"Significance of Pakistan Nuclear Developments Described," *The Telegraph* (Calcutta), 4 October 1988.

[43]"How Pakistan Made Nuclear Fuel."

[44]*Long Road to Chaghi,* p. 70.

[45]"How Pakistan Made Nuclear Fuel."

[46]Ibid.

[47]*Long Road to Chaghi*, p. 70.

[48]Ibid.

[49]Ibid. p. 71.

[50]Shahid-ur-Rehman, "Pakistanis Tell of Indigenous U Mining and Milling Effort," *Nuclear Fuel*, December 1, 1986, pp. 6-7.

[51]"A Science Odyssey: Pakistan's Nuclear Emergence."

[52]*Long Road to Chaghi*, p. 67.

[53]Weismann and Krosney, *The Islamic Bomb,* (New York: Times Books, 1981), p. 218.

[54]Ibid.

[55]*Long Road to Chaghi,* p. 67.

[56]Ibid, p. 71.

[57]Ibid.

[58]Ibid.

[59]Kamal Matinuddin, *Nuclearization of South Asia* (Karachi: Oxford University Press, 2002) p. 101.

[60]*Long Road to Chagai*, p. 68.

[61]Ibid.

[62]"Chaghi Medal Award Ceremony Speech."

[63]*The Islamic Bomb,* pp. 211 and 218-220.

[64]*Eating Grass*, p. 142.

[65]Jerry Lewis, "Got Gas: Iran Stinks at Making UF6," Arms Control Wonk, August 13, 2005. http://www.armscontrolwonk.com/archive/200724/got-gas-iran-stinks-at-making-uf6/; Also see Alexander H. Montgomery, Ringing in Proliferation: How to Dismantle an Atomic Bomb Network, *International Security*, Vol. 30, No. 2 (Fall 2005), pp. 153-187. https://cisac.fsi.stanford.edu/sites/default/files/Montgomery_IS.pdf

[66]*Long Road to Chagai*, pp. 72-73;

[67]Ibid,pp. 72-74.

[68]"How Pakistan Made Nuclear Fuel."

[69]"Development and Significance of Pakistan's Nuclear Capability," p. 155-156.

[70]Ibid; Also see: Zia H. Siddiqui and I. H. Qureshi, "Nuclear Power in Pakistan," *Nucleus*, Vol. 42, No. 1-2 (2005), pp. 63-66.

[71]"How Pakistan Made Nuclear Fuel."

[72]*Long Road to Chaghi,* p. 97.

[73]"How Pakistan Made Nuclear Fuel."

[74]Ibid.

[75]Ibid.

[76]"Around the World; Pakistani Official Reports Self-Reliance in Atomic Fuel," *New York Times*, September 1, 1980.

[77]"How Pakistan Made Nuclear Fuel."

[78]M. Amjad Pervez, "Heavy Manufacturing Facilities of Pakistan Atomic Energy Commission," *The Nucleus*, Vol. 42, Nos 1-2 (2005), pp. 97-105.

[79]Shahid-ur-Rehman Khan, "Zia Order Pakistan AEC to Design Indigenous

Nuclear Reactor," *Nucleonics Week*, November 13, 1986, pp. 3-4.

[80]*Long Road to Chagai*, p. 94; *Eating Grass*, p. 201.

[81]"Medal Award Ceremony Speech."

[82]Ibid.

[83]Ibid.

[84]*Eating Grass*, p. 197; "How Pakistan Made Nuclear Fuel."

[85]Dr. N.M. Butt, "Nuclear Radiation Education and Nuclear Science and Technology in Pakistan," Paper presented at the 2nd International Congress on Radiation Education, Debrecen, Hungary, 20-25 August 2002.

[86]"[P]AEC Journal Says the Nation Has Mastered Front End of Fuel Cycle," *Nuclear Fuel*, 25 March 1985, Vol. 10, No. 6, p. 10.

[87]*Eating Grass*, p. 116.

[88]"Medal Award Ceremony Speech."

[89]Munir Ahmad Khan, "Salam Passes into History," *The News* (Islamabad),November 24, 1996.

[90]*Long Road to Chaghi,* p. 31.

[91]*The Islamic Bomb,* pp. 70-72

[92]Ibid, p.74.

[93]George Perkovich, "Could Anything Be Done To Stop Them? Lessons from Pakistan," Paper for the Nonproliferation Policy Education Center, 26 July, 2006. http://www.npolicy.org/article.php?aid=285&rid=6.

[94]Munir Ahmad Khan, "Significance of Chashma Plant" *Dawn* (Karachi),August 8, 1993.

[95]P.L. Bhola, *Pakistan's Nuclear Policy*, (New Delhi: Sterling Publishers Private Limited, 1993), p. 58; Naeem Salik, *The Genesis of South Asian Nuclear Deterrence* (Karachi: Oxford University Press, 2009), p. 84.

[96]"Significance of Chashma Plant."

[97]Allan S. Krass, et. al. Uranium Enrichment and Nuclear Weapon Proliferation", *Stockholm International Peace Research Institute*, Taylor & Francis Ltd. (London & New York) 1983.p. 232.

[98]*The Islamic Bomb,* p. 75.

[99]Ibid, pp. 76-78.

[100]Ibid, 76.

[101]"Could Anything Be Done to Stop Them? Lessons from Pakistan."

[102]*The Islamic Bomb,* p. 76.

[103]Ibid.

[104]Ibid, p. 147.

[105]International Institute for Strategic Studies (IISS), "Iran's Nuclear, Chemical, and Biological Capabilities: A Net Assessment," February 3, 2011.

[106]Personal communication with Munir Ahmad Khan, March 1999, Islamabad.

[107]Ibid, p. 78-80.

[108]Ibid.

[109]*Morning News* (Karachi), October 22, 1975; See Samina Ahmed, "Franco-Pakistan Relations-II: The Issue of the Reprocessing Plant," *Pakistan Horizon*, Vol. 31, No. 1 (First Quarter, 1978).

[110]*The Islamic Bomb,* p. 167.

[111]*The Islamic Bomb,* p. 137-157.

[112]Ibid, pp. 167-171.

[113]Munir Ahmad Khan, "Significance of Chashma Plant" *Dawn* (Karachi), August 8, 1993.

[114]*The Islamic Bomb,* p. 67; Jeffrey T. Richelson, *Spying on the Bomb,* (New York: W.W. Norton & Company Inc. 2006). p. 339.

[115]*Morning News* (Karachi), June 12, 1977

[116]*The Pakistan Times* (Lahore), May 16, 1976.

[117]Ibid.

[118]Munir Ahmad Khan, "Bhutto and the Nuclear Program of Pakistan," *The Muslim* (Islamabad), April 4, 1995.

[119]David Albright and Serena Kelleher-Vergantini, "Pakistan's Chashma Plutonium Separation Plant: Possibly Operational, Institute for Science and International Security, February 20, 2015. http://isis-online.org/uploads/isis-reports/documents/Chashma_February_20_2015_Final.pdf.

[120]*The Islamic Bomb,* p. 77.

[121]*Spying on the Bomb,* p. 341; Mark Hibbs, "Hot Laboratories,"*Der Spiegel* (Hamburg), February 27, 1989, p. 113.

[122]*Long Road to Chaghi,* p. 37.

[123]*The Islamic Bomb,* p. 84.

[124]Ibid, p.81.

[125]Ibid, p.80.

[126]Ibid, p. 222.

[127]Central Intelligence Agency, *Pakistan: A Safeguards Exemption as a Backdoor to Reprocessing*, May 20, 1983, pp. 1-2.

[128]Zia Mian and A.H. Nayyar, "An Initial Analysis of Kr-85 Production and Dispersion from Reprocessing in India and Pakistan, "*Science and Global Security*, Vol. 10, No. 3, (2002).

[129]*The Genesis of South Asian Nuclear Deterrence*, p. 114.

[130]Mudassar F. Wyne, "PARR-2 and its Utilization," *The Nucleus,* Vol. 29, No.1-4 (1992), p.31.

[131]Aijaz Karim and Showket Pervez, "Renovation and Up-gradation of PARR-1" *The Nucleus,*Vol.29, No. 1-4 (1992), p.7.

[132]Ibid, pp. 7-11.

[133]"Significance of Chashma Plant."

[134]Zia H. Siddiqui and I. H. Qureshi, "Nuclear Power in Pakistan," *Nucleus*, Vol. 42, No. 1-2 (2005), p. 65.

[135]Parvez Butt, "Economics of Nuclear Power, "*The News*(Islamabad),December 11, 1995.

[136]"Significance of Chashma Plant."

[137] "Economics of Nuclear Power."

[138]*The Islamic Bomb,* p. 222.

[139]M. Amjad Pervez, "Heavy Manufacturing Facilities of Pakistan Atomic Energy Commission, "*The Nucleus*, Vol. 42, Nos 1-2 (2005), pp. 97-105.

[140]Ibid.

[141]Mansoor Ahmed, "Why Pakistan Needs Tactical Nuclear Weapons," *Weekly Pulse* (Islamabad), May 6, 2011.

[142]"Reprocessing Plant Construction- A National Commitment," *Dawn* (Karachi), July 4, 1977.

[143]Zahir Kazmi, "Letter from Pakistan: How an unfair non-proliferation regime undermines nuclear security," *Bulletin of the Atomic Scientists*, August 30, 2012. http://thebulletin.org/letter-pakistan-how-unfair-non-proliferation-regime-undermines-nuclear-security.

CHAPTER: 2

PAKISTAN'S EVOLVING NUCLEAR DOCTRINE

Naeem Salik

Preamble

The basic purpose of military doctrines whether conventional or nuclear is to provide guidelines on when and how military forces are to be used. They also help us determine the force configuration and the type and number of weapons and delivery systems. The nature of the doctrine itself is governed by the threat perception, availability of resources including the industrial capacity, strategic raw materials, human resources and size of territory relative to those available to the adversary. The conventional doctrines can be offensive or defensive while nuclear doctrines are aimed at deterring war either through the employment of deterrence by punishment, which relies on the threat of unacceptable costs in case of a hostile action by the enemy or deterrence by denial which

entails nuclear war fighting as well.

In the selection of the type of doctrine whether conventional or nuclear the freedom of choice does not lie with the concerned state but is dictated by the constraints of geography, the size of the population, economic potential including the availability of strategic raw materials and advanced industrial units. In Pakistan's case its choices are limited by its geographical size, shape and orientation that reduces its strategic depth vis-a vis India thereby forcing upon it the adoption of a forward defensive posture to protect its politically sensitive cities and strategic communication networks that lie in the vicinity of the international borders. Similarly, while choosing a suitable nuclear use doctrine it has to cater for the quantitative and qualitative advantages India enjoys in conventional forces which means that it has to keep the option of a nuclear first use open. As a corollary to this Pakistan's nuclear doctrine also remains sensitive to changes in India's conventional war doctrines which should explain the measures it has taken in the nuclear domain to deal with India's Cold Start doctrine.

Pakistan embarked on the acquisition of a nuclear weapons capability in earnest in 1974 after the Indian nuclear test in May of that year. However, following the Indian test the international restrictions on any transfer of nuclear technology started tightening up and export control mechanisms such as the NSG came into being.[1] Given the adversarial relations between India and Pakistan it was anticipated that after the Indian nuclear explosion Pakistan is bound to follow suit. It was felt that India had already crossed the line but it was still possible to restrain Pakistan. Consequently, the United States exerted a lot of pressure on both France and

Pakistan for the cancellation of the agreement by France for the provision of a nuclear reprocessing plant to Pakistan.[2] The Carter administration also imposed economic and military sanctions on Pakistan under the Symington and Glenn amendments.[3] Faced with politico-diplomatic and economic pressure and threats of preventive strikes on its fledgling nuclear facilities Pakistan adopted a policy of denial of the pursuit of any military nuclear program in the period between 1974 and 1998. Though it sent out subtle signals about its prowess in nuclear technology from time to time which helped it achieve what George Perkovich has termed as a 'non-weaponized deterrence.'[4] This policy of ambivalence and denial helped mitigate the international pressures but as a downside it stifled any public debate about issues related to a prospective nuclear doctrine, command and control and safety and security mechanisms. While this inhibition about a public discourse is understandable, it was surprising that neither there was an academic discussion nor an internal deliberation of these critical aspects of nuclear capability within the military and civilian bureaucracies. As a result the intellectual debate lagged far behind the technological developments and in the aftermath of the overt demonstration of nuclear capability in May 1998, in response to India's nuclear tests earlier that month, Pakistan was suddenly faced with the challenge of formulating a nuclear doctrine and to establish a nuclear command and control system. Peter Lavoy has written that, before May 1998;

> Nuclear weapons had not been integrated into Pakistani military plans, the armed forces had no nuclear doctrine to speak of, and command and control over the nuclear arsenal and delivery systems was only vaguely defined and loosely organized.[5]

Post 1998 Development of a Nuclear Doctrine

Early Thoughts

Immediately after the nuclear tests a small group of officers was assembled at the Army Headquarters at Rawalpindi and assigned the task of formulating the initial draft of a nuclear use doctrine and the organizational structure of an institutionalized nuclear command and control system. The task was accomplished in the following three to four months.[6] However, it could not be formally approved due to the change in army's command in October 1998. The two documents were presented to the new army chief and the senior military leadership in February 1999 and were tentatively approved pending the formal approval of the civilian government. The Prime Minister and key members of his cabinet were briefed on the proposed doctrine and command and control organization in April 1999.[7] Though the political leadership agreed to the proposals in principle, they stopped short of giving a final approval and asked for some more time for further deliberations by a committee of cabinet ministers. The civilian leadership, however, continued to vacillate and failed to take a decision until the military took over power in Pakistan in October 1999. The military led government accorded a high priority to the subject and in a joint meeting of the cabinet and the National Security Council the proposed nuclear doctrine and the command and control structure were formally approved in February 2000.[8] It was decided to pronounce the details of the command and control organization but to hold back the announcement of the nuclear doctrine for several reasons. Pakistan was already facing international criticism and US imposed military and economic sanctions because of the nuclear tests it had conducted in May 1998, when in early 1999 a military conflict broke out in the Kargil

sector of the Line of Control dividing Indian and Pakistani held areas of the disputed state of Jammu and Kashmir. Pakistan was held responsible for initiating this conflict and was being portrayed as an irresponsible nuclear state by the international community.

The military coup in October 1999 further isolated the country and triggered additional sanctions. In the meantime, in August 1999 India had announced its Draft Nuclear Doctrine.[9] It was therefore considered that announcement of a nuclear use doctrine by Pakistan in the prevailing environment would be seen as another provocative step and a tit-for-tat response to the Indian doctrine and thus the declaration of the nuclear doctrine was held back. Later, a string of events such as 9/11, military stand-off with India in 2001-02 and revelation of AQ Khan's network did not allow any space for declaration of the nuclear doctrine. Pakistan, later found virtue in the fact that any ambiguity in the doctrine adds to deterrence and complicates the calculus of the opposing side and therefore, the doctrine is yet to be formally released but its salient aspects have been alluded to by senior civilian and military leaders on various occasions. According to a South Asia expert, 'Pakistani officials have repeatedly indicated that they do not intend to [release a doctrinal statement], believing that ambiguity best serves national interests on nuclear matters."[10] He has, therefore, acknowledged at the outset of his article on Pakistan's nuclear strategy that it is "highly conjectural, and that his analysis is based on a 'limited public record, inferences, and twenty years of visiting Pakistan."[11] This statement clearly indicates that most analyses of Pakistan's nuclear doctrine are speculative and conjectural at best, and while some are closer to reality the others are way off the mark.

At the very outset it was decided that since the main purpose

of Pakistan's nuclear doctrine is to deter all kinds of aggression whether conventional or nuclear, a minimum deterrence doctrine would suffice. However, feeling somewhat uncomfortable with the minimal level of deterrence, which could be vulnerable to a disabling first strike, the qualifier 'credible' was prefixed to the minimum deterrence not unlike India, which meant that the size of the force would be something more than minimal. A prominent US expert of South Asian nuclear scene, Rodney W. Jones agrees that, "the term credible is much more demanding criterion than 'minimum deterrence' might imply by itself."[12] The declaration of credible minimum deterrence doctrines by both India and Pakistan were also designed to deflect international concerns about a possible nuclear arms race in South Asia by projecting themselves to be responsible international players. The Pakistani planners were also conscious of the economic weaknesses and vulnerabilities of the country and took a deliberate decision to devise a doctrine that would be in line with its resource constraints and would avoid the onset of a debilitating arms race with India. At the unofficial level also similar ideas were being discussed. In a joint newspaper article three senior retired officials; former Foreign Minister Agha Shahi, ex-Foreign Secretary Abdul Sattar and former Air Chief Zulfiqar Ali Khan argued that Pakistan should not fritter away its limited resources in building up an unnecessarily large arsenal suggesting that:

> Deterrence was the sole aim and a small arsenal was considered adequate. At no time did Pakistan contemplate use of nuclear weapons for war fighting or seek to develop capability for a pre-emptive attack. Apart from the obvious constraints of resources, it was not so unrealistic as to entertain such thoughts. India is too large and too well armed to be vulnerable to a disabling strike. Besides, any such attempt would provoke retaliation with disastrous

> consequences.[13]

This argument clearly indicates a rational and realistic approach to deterrence keeping in view Pakistan's security environment and its resource scarcity. However, these senior analysts did not suggest any figure to quantify the size of a prospective Pakistani nuclear arsenal. Rather they expressed their belief that minimum deterrence doesn't denote a static number but it is a dynamic concept that is subject to change with changing circumstances stating that:

> Minimum deterrence has been and should continue to be the guiding principle of Pakistan's nuclear pursuit. Of course minimum cannot be defined in static numbers. In the absence of mutual restraints, the size of Pakistan's arsenal and its deployment pattern have to be adjusted to ward off dangers of pre-emption and interception. Only then can deterrence remain efficacious.[14]

This point was again reiterated during an international seminar on Command and Control of Nuclear Weapons held at Islamabad in February 2000, when former Foreign Minister Agha Shahi invoked the traditional "action-reaction syndrome" that has dominated Indo-Pakistani relations for more than half a century. Arguing that, since India wanted to keep the size of its minimum deterrent flexible and subject to change with changing circumstances, Pakistan would perforce have to respond with equivalent flexibility in its own conception of a minimum deterrent.[15]

Abdul Sattar who later became the Foreign Minister in General Musharraf's government reiterated the above precepts stating that, "Minimum nuclear deterrence will remain the guiding principle of our nuclear strategy. The minimum cannot be quantified in static numbers. The Indian build up would necessitate review and reassessment…… But we shall not engage in any nuclear

competition or arms race."[16] Later in an address at the National Defense College in Islamabad, Sattar elaborated that:

> For the past decade or so, nuclear capability has been the bedrock of our defense and security policy… its sole purpose is to deter and prevent war. Pakistan neither aspires to great power status or permanent membership of the Security Council nor nourishes any designs for regional dominance... Our policy of Minimum Credible Deterrence will obviate any strategic arms race…[17]

President Musharraf used the term 'minimum defensive deterrence' in some of his statements, basically to underline the defensive nature of Pakistani nuclear doctrine.[18] Sifting through the statements made by Pakistani leaders and senior government officials one can list the guiding principles of Pakistan's nuclear doctrine as under:

- Pakistan's policy will be based on a credible minimum deterrence.
- It will avoid getting embroiled in a strategic arms race with India.
- It will continue to support international arms control regimes, which are nondiscriminatory in nature.
- Pakistan's nuclear policy will be conducted with 'restraint' and 'responsibility'.
- It will refrain from further nuclear testing. However, this commitment is subject to change in case India decides to resume testing.
- Pakistan will strengthen existing controls on the export of nuclear technology through development of requisite administrative and legal mechanisms.

According to Michael Krepon, Pakistan's nuclear doctrine rests on four main pillars as under:[19]

- *First, they assert that Pakistan's nuclear deterrent is India-specific.*
- *Second, Pakistan has embraced a doctrine of credible minimum deterrence.*
- *Third, the requirements for credible, minimal deterrence are not fixed.*
- *Fourth, given India's conventional military advantages, Pakistan reserves the option to use nuclear weapons first in extremis.*

Another strategic analyst with good insight into Pakistani strategic thinking contends that, Pakistan's strategic deterrence policy is based on five major elements:[20]

- *An effective conventional fighting force and the demonstrated resolve to employ it against a wide range of conventional and sub-conventional threats.*
- *A minimum nuclear deterrence doctrine and force posture.*
- *An adequate stockpile of nuclear weapons and delivery systems to provide for an assured second strike.*
- *A survivable strategic force capable of withstanding sabotage, conventional military attacks and at least one enemy nuclear strike.*
- *A robust strategic command and control apparatus designed to ensure tight negative use control during peacetime and prompt operational readiness at times of crisis and war.*

However, it needs to be understood that the above five elements are closely related and are interdependent on each other. In this regard, the relationship between the first two elements is especially critical to any decision on Pakistan's nuclear posture as will be highlighted later.

Doctrinal Objectives

Pakistan seeks to achieve following three objectives from its nuclear doctrine:

- Deter any nuclear attack or nuclear blackmail.
- Deter all kinds of conventional military aggression against its territory whether a full-fledged war or a limited one.
- Reduce its defense expenditure by relying on the effectiveness of its nuclear deterrence rather than stretching its economic resources in trying to catch up with India's growing conventional capabilities.

Evolving Nuclear Posture

In the past few years Pakistan's nuclear program has been labeled by the international media as well as academic and security analysts as the 'fastest growing' nuclear program in the world. This cliché has been loosely used without much justification on the basis of the operationalization of two plutonium production reactors of 40 MW each. Operating at 60-80% capacity these reactors can barely produce plutonium worth 2 weapons each per year. Two more reactors of similar capacity are at various stages of completion and even with all four of these reactors coming on line their combined annual capacity would be eight weapons worth of plutonium at best. Add to this the speculated production of approximately four weapons worth of HEU it is difficult to imagine any justification for the title of the fastest growing nuclear program. In addition to this, another development that has created a lot of commotion amongst the security analysts and media is Pakistan's testing of a short range nuclear capable missile Hatf-XI (NASR). This

missile with a range of 60 kilometers is capable of carrying low yield nuclear warheads and can be fired from a mobile platform with multiple launch capability.[21] There has been too much focus on the short range and therefore destabilizing potential of this weapon system along with associated problems of command and control and physical security in the immediate battle zone. This narrow focus on NASR has actually overshadowed some related and very important aspects of this development. More significant than testing of this short range battlefield nuclear weapon system is the fact that Pakistan has achieved the technological capability of miniaturization of its warheads which has allowed for such a weapon with limited payload capacity to be nuclear armed. This capability has important implications for the development of naval nuclear delivery systems as well as arming of Pakistan's cruise missiles with nuclear warheads. The testing of NASR is as yet demonstration of a capability for options enhancement and threat manipulation to deny India the space it is seeking to use its conventional preponderance at levels of conflict below the nuclear threshold. Senior Pakistani officials in the National Command Authority have repeatedly asserted that there will be no pre-delegation of command in case battlefield nuclear weapons are deployed and the operational control will remain centralized besides claiming that requisite arrangements have been made to ensure the physical security of the weapon systems in the field.[22]

The preceding discussion raises two important questions that must be addressed. Firstly, why should any increase in the size of Pakistan's nuclear arsenal or its fielding of battlefield nuclear weapons come as a surprise and secondly, why has Pakistan chosen to go down this path? The nuclear history and the conduct of the established nuclear powers provides enough evidence to suggest that nuclear doctrines were never static and were constantly

subjected to change to adjust to evolving security environment as well as technological developments. As discussed earlier it had been made amply clear by responsible Pakistani officials that Pakistan's minimum deterrence is not static but dynamic in nature and would be reviewed and modified keeping in view changes in the security environment. It also needs to be recognized that maintenance of a credible minimum deterrence is subject to the maintenance of a credible and effective conventional military capability. Any erosion in the conventional capability would have the undesirable effect of not only lowering of Pakistan's nuclear threshold but create pressures for an expansion in the size of the nuclear forces. The changes in Pakistan's nuclear posture have been necessitated by two important developments. Firstly, India has enunciated and has been war-gaming a new war fighting doctrine called the Cold Start[23] or Proactive Operations Doctrine since 2004. This provocative doctrine envisages attacks by divisional sized Independent Battle Groups on multiple axes after the defensive/pivot corps have made the initial dents in the Pakistani defenses. The doctrine calls for enhancement of offensive capability of forward deployed defensive corps as well as forward positioning of offensive formations in order to deny adequate warning time to Pakistani defenders. This doctrine has created the perpetual threat of a surprise attack. Secondly, a large segment of Pakistani military has been engaged in counter terror/counter insurgency operations along its Western borders over the last decade. This prolonged commitment of a significant part of the armed forces on the Western borders with no end of that conflict in sight, has resulted in relative thinning of Pakistani forces along its Eastern borders with India. The combined effect of these two developments has been to compel Pakistan to not only increase its reliance on its nuclear deterrent forces but also to lower its nuclear

threshold by introducing battlefield nuclear weapons.

As for the increase in the size of Pakistani arsenal it has again been necessitated by two factors. Firstly, India has been pursuing a missile defense shield for many years and its scientists have claimed in the recent past that they have made progress to an extent that they can effectively defend at least two major cities against incoming ballistic missiles. Irrespective of the unproven and doubtful capability of India's BMD once deployed it is going to psychologically erode the credibility of Pakistan's nuclear deterrence even if it is incapable of doing it physically. Pakistan has, therefore, been compelled to introduce both qualitative as well as quantitative upgrades in its nuclear arsenal. Secondly, the US-India civil nuclear cooperation agreement, that will enable India to enhance its fissile material production capacity substantially by allowing it to import uranium fuel thereby freeing its limited domestic uranium resources to be diverted to fissile material fabrication, would widen the gap between the fissile stocks of the two countries. This will eventually allow India to develop a preponderance both in conventional and nuclear capabilities vis-à-vis Pakistan. Pakistan's on-going effort to expand its plutonium production and reprocessing capacities should be viewed as an effort on part of Pakistan to maintain the credibility of its deterrence.

After the testing of NASR weapon system and further development of another short range system Abdali with a range of 180 kilometers, Pakistani officials have been using new formulations such as 'full spectrum deterrence' and 'assured deterrence' and flexible deterrence options.[24] However, without getting into the semantics there appears to be some dichotomy in Pakistan's declaratory nuclear policy and its operational nuclear posture. As the statements of government spokespersons suggest the

declaratory policy continues to be 'Credible Minimum Deterrence,' while the introduction of battlefield nuclear weapons suggests a move towards nuclear war fighting and some sort of a graduated deterrence, which is at cross purposes to minimum deterrence and would require larger numbers and greater variety of weapons and delivery systems. Pakistan will have to resolve this dilemma sooner or later.

Recent Developments

In the recent past India has been conducting sea trials of its indigenous nuclear powered submarine 'Arihant' and has also conducted test firings of Submarine Launched Ballistic Missiles (SLBMs) K-4 and K-5 besides testing land attack cruise missiles from submerged platforms. These developments have not only provided India with an assured second strike capability they have taken the nuclear competition between India and Pakistan into a new domain and resulted in the nuclearization of the Indian Ocean. Pakistan, lacking a nuclear powered submarine of its own has responded with the test launch of Babur-3 land attack cruise missile with a range of 450 kilometers from one of its conventional diesel-electric submarines thereby demonstrating its own assured second strike capability. However, this appears to be an interim arrangement given the technological limitations of the conventional submarines pending Pakistan's fielding of its own nuclear powered submarines. The introduction of the nuclear weaponry into the maritime domain will also pose challenges of command and control and communications for both India and Pakistan and will also lead to greater investments in anti-submarine warfare. The current recessed nuclear posture wherein the warheads and delivery vehicles are kept separately would not be possible to maintain at sea where there would be no

geographical space between the warheads and delivery systems. The difficulty of communicating with a submerged submarine also forces a degree of delegation of command and control to the submarine commanders. How would this change in the readiness state and delegation of command in one segment of the strategic forces would impact the other two legs of the triad is yet to be seen.

The other major technological breakthrough has been the testing by Pakistan of its new medium range missile designated as 'Ababeel' with a capability to carry multiple independently targetable re-entry vehicles (MIRVs). This is clearly Pakistani response to India's decision to develop and deploy ballistic missile defense systems around at least two major cities Delhi and Mumbai. Though, one could have serious doubts about the efficacy of India's BMDs, the psychological aspects of a false sense of security it bestows upon the possessor and the tendency towards a pre-emptive first strike that it encourages could not be brushed aside by Pakistan. Reports suggest that India is also working to field its own MIRVed missiles ostensibly to catch up with the Chinese. The introduction of MIRVs however will have a serious impact on existing targeting preferences and operational postures and would necessitate a review of the existing doctrines and policies.

CONCLUSION

It is evident that during the past decade and a half Pakistan's nuclear doctrinal thinking has come a long way in terms of evolution. Not only has the doctrinal thinking matured it has become more sophisticated and nuanced. It has also shown the required flexibility and dynamism to adjust to the changes in the security environment as well as technological developments. It

would be unfair to assume that Pakistan's nuclear doctrine will not undergo any further changes in the future given the dynamic nature of military doctrines and the fact that during four and a half decades of the Cold War, nuclear doctrines of the super powers and other major nuclear powers were perpetually changing in response to changes in international security environment as well as technological developments.

Notes

[1]William Burr, 'The United States and the Origins of the Nuclear Supplier's Group 1974-76: Nuclear Nonproliferation through Export Regulations'. Paper presented at a conference at ETH Zurich in June 2010.

[2]Dennis Kux, *The United States and Pakistan, 1947–2000: Disenchanted Allies*, Woodrow Wilson Center Press, Washington, D.C., 2001, p.235.

[3]Ibid., p. 236-39.

[4]*Strategic Studies*; Vol XVII, Autumn-Winter 1994, Institute of Strategic Studies, Islamabad.

[5]Peter R. Lavoy, 'Islamabad's Nuclear Posture: Its Premises and Implementation', in Henry D. Sokolski eds., *Pakistan's Nuclear Future: Worries Beyond War,* Strategic Studies Institute, US Army, p. 129- 165. Available at http://www.StrategicStudiesInstitute.army.mil/

[6]Author's personal knowledge of events being part of the group.

[7]Ibid.

[8]Press Statement released by Associated Press of Pakistan (APP) on 03 February 2000.

[9]Complete Text of India's Draft Nuclear Doctrine based on the report of National Security Advisory Board is available at Appendix 4 to P. R. Chari, Sonika Gupta and Arpit Rajain eds., *Nuclear Stability in Southern Asia*, New Delhi, 2003, Manohar, p. 184-88.

[10]Michael Krepon, 'Pakistan's Nuclear Strategy and Deterrence Stability,' www.stimson.org/.../Krepon_-_Pakistan_Nuclear_Strategy_and_Deterrence_Stability.pdf

[11]Ibid.

[12]Rodney W. Jones, 'Minimum Nuclear Deterrence Postures in South Asia: An Overview', Defense Threat Reduction Agency, Advanced Systems and Concepts Office, Final Report, October 1, 2001, p. 3.

[13]Agha Shahi, Zulfiqar Khan & Abdul Sattar, 'Securing Nuclear Peace', *TheNews International*, 5 October 1999.

[14]Agha Shahi, Abdul Sattar and Zulfiqar Khan, op. cit.

[15]*Strategic Issues*, Institute of Strategic Studies, Islamabad, March 2000.

[16]*Strategic Issues*, Institute of Strategic Studies, Islamabad, March 2000, p. 2–3.

[17]Abdul Sattar, address at the National Defense College, Islamabad, May 24, 2000.

[18]'No Compromise on minimum deterrence', *The News International,* Islamabad, April 6, 2005.

[19]Michael Krepon, op. cit.

[20]Peter R. Lavoy, 'Pakistan's Nuclear Posture: Security and Survivability,' *Non proliferation Policy Education Center* (NPEC), 2017 available at http://www.npolicy.org

[21]Inter Services Public Relations, Pakistan, Press Release No. 94/2011-ISPR. http://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=1721#pr_link1721

[22]Author's conversation with very high level officials in the nuclear chain of command in July 2012.

[23]Walter C. Ladwig, 'A Cold Start for Hot Wars,' *International Security*, Vol. 32, No. 3, Winter 2007/08, p. 158-190.

[24]Adil Sultan, 'Pakistan's emerging nuclear posture: impact of drivers and technology on nuclear doctrine,' *Strategic Studies,* Institute of Strategic Studies, Islamabad, vol. XXXI & XXXII, Winter 2011 & Spring 2012, nos. 4 & 1.

CHAPTER: 3

PAKISTAN'S NUCLEAR LEGISLATIVE REGIME

Ahmer Bilal Soofi

The last few decades have witnessed an enormous growth and development in international nuclear law relating to nuclear energy and nuclear weapons. In response, various states around the world, including the United States, the United Kingdom and India, have extensively developed their domestic nuclear law regimes. Notably, there has also been a commensurate legal, regulatory and administrative evolution of Pakistan's domestic nuclear law to give effect to the state's international obligations, as a consequence of which Pakistan today is recognized by the global community as a responsible nuclear weapons state.

This chapter, in addition to highlighting the historical and contemporary developments in international nuclear law, elucidates upon the salient features of Pakistan's domestic nuclear

law architecture in five thematically organized sections.

I.

Since the adoption of the UN Charter, international nuclear law has grown exponentially while expanding its reaches into several different fields. In order to provide a visual sense to the reader of the vastness that international nuclear law has acquired over a brief period of time, major international nuclear law instruments currently in force in the form of treaties/conventions and United Nations Security Council (UNSC) Resolutions are as follows:

- IAEA Statute & Safeguard Agreements
- Nuclear Non-Proliferation Treaty 1968
- India-Pakistan Agreement on Non-Attack on Each Other's Nuclear Installations.
- Paris Convention on Third Party Liability in the Field of Nuclear Energy 1960
- Vienna Convention on Civil Liability for Nuclear Damage 1963
- Assistance in Case of a Nuclear Accident or Radiological Emergency Convention 1986
- Nuclear Safety Convention 1996
- International Convention for the Suppression of Acts of Terrorism 2005
- Convention on the Physical Protection of Nuclear Material and Nuclear Facilities 2016
- UNSC Resolution 1172 (1998)
- UNSC Resolution 1540 (2004)
- UNSC Resolution 1673 (2006)

- UNSC Resolution 1810 (2008)
- UNSC Resolution 1977 (2011)
- UNSC Resolution 2055 (2012)
- UNSC Resolution 2270 (2016)

The oversight, maintenance and development of international nuclear law instruments is entrusted to several international institutions including the International Atomic Energy Agency (IAEA); the United Nations Security Council and its 1540 Committee; the New-York based First Committee of the United Nations General Assembly; the Geneva-based Conference on Disarmament, and the United Nations Office of Disarmament Affairs.

II.

The peaceful use of nuclear energy began being regulated at a global level in 1957 under the IAEA Statute,[1] an international treaty establishing the Vienna-based International Atomic Energy Agency. Pakistan has been a major recipient of technical cooperation from the IAEA, and is one of 35 members of its Board of Governors.

IAEA's principal purpose was and remains so to supervise peaceful uses of nuclear power and ensure that fissile material is not diverted to any other use. To that end, it has created an extensive regime of various types of safeguard agreements whereby a state seeking nuclear assistance and cooperation from a state with developed nuclear technology and knowhow enters into a legally binding agreement with it known as a safeguard agreement. Such

agreements generally permit IAEA inspectors to visit the sites for which nuclear assistance is received and themselves examine whether the uses are peaceful or not. Several such standardized agreements have been issued by the IAEA's legal division. It has, moreover, created a regime of tripartite agreements incorporating the role of IAEA inspectors along with binding the state extending support and the state receiving it.

The IAEA is also a leading publisher in the nuclear field. Its more than 9,000 scientific and technical publications include international safety standards, technical guides, conference proceedings and scientific reports. They cover the breadth of the IAEA's work, focusing on nuclear power, radiation therapy, and nuclear safety and security, among others.

In order to benefit from the peaceful use of nuclear energy, Pakistan has sought assistance from the United States, Canada, France and China through legal framework comprising tripartite contracts and safeguard agreements with the IAEA. These include agreements on: 1) Pakistan Research Reactor-1 (PARR-1) signed in 1962 and published by the IAEA as INFCIRC/34; 2) Karachi Nuclear Power Plant (KANUPP) signed in 1968 and published as INFCIRC/116; 3) Karachi Nuclear Power Plant (KANUPP) signed in 1969 and published as INFCIRC/135; 4) Fuel Reprocessing Plant signed in 1976 and published as INFCIRC/239; 5) Hawks Bay Depot signed in 1977 and published as INFCIRC/248; 6) Pakistan Research Reactor-2 (PARR-2) signed in 1991 and published as INFCIRC/393; 7) Chashma Nuclear Power Plant-1 (C-1) signed in 1998 and published as INFCIRC/418; 8) Chashma Nuclear Power Plant-2 (C-2) signed in 2007 and published as INFCIRC/705; and

9) Chashma Nuclear Power Plant-3 & 4 (C-3/C-4) signed in 2011 and published as INFCIRC/816.

These safeguards agreements concluded by Pakistan are governed by the IAEA's INFCIRC/26 and INFCIRC/66/Rev.2. Significantly, the 66-type safeguards applicable to Pakistan are classified either as item-specific safeguards or as a facility-specific safeguards, and therefore cover only specified facilities and/or materials, with the remit of the IAEA circumscribed only to the safeguarded facilities or materials. They, thus, do not extend to cover the totality of the state's nuclear activities but in substance are in some sense stricter than the IAEA's Comprehensive Safeguard Agreement.

To domestically implement these binding international agreements, Pakistan enacted the Pakistan Atomic Energy Commission Ordinance 1965 ('PAEC Ordinance'),[2] its first nuclear statute establishing the PAEC itself and granting it powers to interface with the IAEA and make commitments under safeguard agreements and other relevant laws on behalf of the Federation of Pakistan. Although PAEC Ordinance granted independence to PAEC Board, it operated subject to any directions that the Federal Government may issue from time to time pursuant to Section 16 of the Ordinance.

Pakistan's peaceful nuclear program commenced its operations under the PAEC's legal umbrella. Back in 1965, Pakistan had no designs or intentions to develop a nuclear device for the military purpose of self-defense against unlawful external aggression upon its sovereignty and territorial integrity. Thus, its nuclear program at the time, spearheaded by some of the country's brightest scientists

and engineers, was an open one—meaning the IAEA inspectors had full access to declared sites.

Importantly, under the IAEA regime, nuclear energy projects have to conform to certain international standards and specifications issued from time to time by IAEA requiring states pursuing such projects to ensure certain safety measures, radiation control mechanisms, and several other safeguards. This necessitated the creation of an entity, other than PAEC, with oversight as a licensor. To that end, Pakistan Nuclear Safety and Radiation Protection Ordinance 1984[3] was promulgated to be subsequently replaced by another more comprehensive enactment, the Pakistan Nuclear Regulatory Authority Ordinance 2001[4] ('PNRA Ordinance'), which significantly created a relationship between PNRA as licensor and PAEC as licensee for specific nuclear projects and their sites. The PNRA Ordinance, in Section 19 (1) (a) prohibits persons or entities if not licensed from the manufacture, production, acquisition or development of nuclear material. It also ensures through Sections 51 and 52 that each nuclear installation has qualified and trained personnel by mandating reliability check of relevant personnel.

Henceforth, PNRA would grant a license to PAEC to set up, for example, a nuclear power plant, with the terms of the license including all the IAEA requirements and safety standards etc. As the licensing authority, PNRA would oversee compliance with the terms of the license. In addition to creating this enhanced oversight framework, PNRA statute was also framed to domestically implement several international conventions on nuclear safety,[5] including assistance in case of a nuclear accident or radiological emergency.[6] In this context, PNRA has formulated extensive rules

with respect to safety of sites, population density around sites etc. PNRA, additionally, acts as the implementing body for principles set forth in nuclear civil liability conventions that aim to curtail all risks of nuclear accidents causing trans-boundary damage. These include the Vienna Convention on Civil Liability for Nuclear Damage 1963, and the Paris Convention on Third Party Liability in the Field of Nuclear Energy 1960.

In line with its functions and powers laid down in Section 16 of the PNRA Ordinance, PNRA has issued several key domestic regulations which are updated from time to time for consistency with the IAEA's latest recommendations and specifications. Currently, these include: Pakistan Nuclear Regulatory Authority Enforcement Regulation (PAK/950) issued in 2010; Regulations on the Safety of Nuclear Research Reactor(s) Operation (PAK/923) issued in 2012 and updated in 2015; Regulations for the Safe Transport of Radioactive Material (PAK/916) issued in 2007; Regulations on Radioactive Waste Management (PAK/915) issued in 2005 and updated in 2010; Regulations on Management of a Nuclear or Radiological Emergency (PAK/914) issued in 2008; Regulations on Safety of Nuclear Power Plants-Operation (PAK/913), issued in 2004 and amended in 2015 that includes measures for secure production, use, storage and physical protection of nuclear material and facilities for peaceful purposes, as well as instituting reliability check of relevant personnel; Regulations on the Safety of Nuclear Power Plants-Quality Assurance (PAK/912) issued in 2003 and updated in 2014; Regulation on the Safety of Nuclear Power Plant Design (PAK/911) issued in 2002 and updated in 2014; Regulations on the Safety of Nuclear Installations – Site Evaluation (PAK/910) issued in 2008; Regulation for Licensing of

Nuclear Installation(s) in Pakistan (PAK/909) revision 1 issued in 2012; Regulations for the Licensing of Radiation Facilities other than Nuclear Installations (PAK/908), issued in 2004; Regulations for Licensing of Nuclear Safety Class Equipment and Components Manufacturers (PAK/907) issued in 2001; Regulations on Radiation Protection (PAK/904) issued in 2004 and updated in 2012; Regulations on Transaction of Business of Pakistan Nuclear Regulatory Authority (PAK/901) issued in 2012; Regulations on Licensing Fee by Pakistan Nuclear Regulatory Authority (PAK/900) issued in 2008 and updated in 2015; PNSRP (Treatment of Food by Ionizing Radiation) Regulations, 1996; and Pakistan Nuclear Safety and Radiation Protection Regulations, issued in 1990 and updated in 2012 that include stringent measures for safe production, use, storage, transportation, and physical protection of nuclear materials and facilities for peaceful purposes.

PNRA has additionally published several guidelines and also drafted a National Policy on Waste Management. The guidelines published by the PNRA include: PNRA-RG-911.01 Probabilistic Safety Assessment of Nuclear Power Plant-Level 1 published in 2010; PNRA-RG-904.01 (Rev. 0) Quality Assurance in Nuclear Medicine published in 2009; PNRA-RG-904.02 (Rev. 0) Guidance for the Users of Iodine-131 in Nuclear Medicine Centers published in 2013; PNRA-RG-913.02 (Rev. 0) Format and Contents of Application for Design Modifications in Nuclear Power Plants published in 2013; PNRA-RG-914.01 (Rev. 0) Dosage and Distribution of Potassium Iodide Tablets (a Thyroid Blocking Agent) in Radiation Emergencies published in 2008; PNRA-RG-916.01 (Rev.0) Transportation of Radioactive Material by Road in Pakistan published in 2007; and PAK/9801 RG on

Registration/Licensing and Issuance of NOC to the Exporter(s) of Radiopharmaceuticals published in 2005.

The PNRA comprises of scientists and engineers extensively trained in safety standards, with some of them so highly qualified and experienced that they have ably acted as IAEA inspectors in other countries.

PNRA, with IAEA's cooperation on capacity-building, has also successfully implemented the Nuclear Security Action Plan (NSAP) approved by the Government of Pakistan in 2006 with the aim of (i) strengthening the safety and security of nuclear and radioactive materials and facilities containing such materials; (ii) prevention and detection of illicit trafficking in nuclear and other radioactive materials; and (iii) responding to incidents of illicit trafficking and nuclear and radioactive security emergencies. In implementing the NSAP, PNRA formulated and updated its existing regulations in line with IAEA's document INFCIRC/225 entitled The Physical Protection of Nuclear Material and Nuclear Facilities. Moreover, under the NSAP, a National Nuclear Security Emergency Coordination Centre was established for coordination with such governmental agencies as Customs, border forces, local governments and Regional Directorates and Inspectorates of PNRA in handling any nuclear security emergency at the national level.

III.

A landmark development on the international nuclear scene occurred in 1970 when the Nuclear Non-Proliferation Treaty[7]

(NPT) came into force. NPT is an unusually brief treaty comprising of only XI Articles.[8] When NPT was opened for signature in 1968, only the United States of America, the United Kingdom, France, Russia and China had carried out detonations to establish themselves as nuclear weapons states. By naming these states in its text, NPT conferred legitimacy to their nuclear programs and nuclear weapons. With respect to all the remaining states, NPT effectively declared acquisition of nuclear weapons unlawful pursuant to its Articles II and III.

Despite this embargo on all other states to acquire nuclear weapons, NPT was nevertheless signed and ratified by several other states and today has acquired almost universal membership with 191 state parties.[9] Pakistan, however, viewed NPT as discriminatory and hypocritical and despite pressure decided not to sign it. India and Israel also adopted similar positions. Therefore, the current status of NPT membership is that except for Pakistan, India and Israel, all other states have ratified it.

Constituting the core component of the global non-proliferation regime today, NPT essentially seeks to establish a comprehensive, legally binding framework based on three principles: (1) states without nuclear weapons as of 1967—a year before the treaty opened for signature—agree not to acquire them; (2) the five states known to have tested nuclear weapons as of 1967—the nuclear weapon states (NWS)—agree to not assist other states in acquiring them and to move toward eventual disarmament; and (3) the non-nuclear weapons state (NNWS) are guaranteed access to civilian nuclear technology and energy development. Moreover, NPT subjects NNWS to safeguards to ensure that materials and

technology from civilian activities are not diverted to weapons programs. IAEA, as NPT's implementing body, monitors compliance with the treaty and assists NNWS in developing nuclear technology.

Apart from NPT, two important elements of the non-proliferation regime have never come into effect. First, the Comprehensive Nuclear Test Ban Treaty 1996 CTBT, although signed by 183 states, cannot enter into force until all 44 states with significant military or civilian nuclear capacity ratify it. Thus far, China, Pakistan, India, Israel and the United States have not done so. Notably, in this context, Pakistan has offered India to enter into a bi-lateral treaty on moratorium on nuclear testing in order to maintain strategic stability in South Asia. Second, efforts to conclude a Fissile Material Cut off Treaty (FMCT) to ban the production of weapons-grade material have also stalled at the Conference on Disarmament CD.

Established by the international community in 1979, CD is a specialized forum to negotiate multilateral arms control and disarmament agreements. Its member states include Pakistan and currently number 65. While CD is not formally a UN organization, it is linked with the UN through a personal representative of the UN Secretary-General who serves as its secretary general. Resolutions adopted by the UN General Assembly UNGA often request CD to consider specific matters. In turn, CD annually reports its activities to the UNGA. CD played a critical role in drafting of the CTBT and is currently engaged in discussions on FMCT, a pact to prevent arms race in space PAROS, nuclear disarmament, and negative security assurances.

In addition to IAEA, other multilateral, informal organizations also play a role in implementing and enforcing NPT. These are essentially multilateral export control regimes containing principles and guidelines that states use to organize their national export control systems. Of these, the most notable are the Nuclear Suppliers Group, NSG and the London Suppliers Group. Comprising of 46 advanced nuclear states, NSG prohibits the transfer of civilian nuclear materials or technology to states outside NPT or those not fully compliant with IAEA safeguards. NSG's export bans, however, are not legally binding, prompting members like the United States to pursue civilian nuclear projects with non-NPT members including India.

NSG issues a dual-list of export equipment and the London Suppliers Group a Zangger Trigger list. Accordingly, Pakistan has developed its own export control legal regime and domestic export controls have been introduced. These lists are updated from time to time in line with the latest NSG and Zangger Trigger lists. Dual-use items have been placed on a watch list. Knowledge of these lists is essential for our importers and exporters who often invite sanctions due to lack of such knowledge. Pakistan's customs officials have been specially trained to enforce these controls.

Pakistan's national nuclear legal framework includes legislation, procedures, measures and agencies to control border crossings and export/import and other transfers of nuclear materials. The Customs Act 1969 generally prohibits and restricts the importation and exportation of nuclear materials. The brokering, trading in, negotiating, and otherwise assisting in the sale of nuclear goods and technology is extensively controlled by the Export Control

on Goods Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act 2004 (Export Control Act 2004). The border and other controls are enforced and implemented by several executive authorities including the Pakistan Customs, the Federal Investigation Agency, Pakistan Rangers, Pakistan Police, Railway Police, Airport Security Force, Frontier Corps, Coast Guards, Karachi Port Security Force, and Strategic Export Control Division (SECDIV) in the Ministry of Foreign Affairs.

Significantly, pursuant to the Export Control Act 2004, an export control authority, namely the SECDIV has been established in the Ministry of Foreign Affairs. The SECDIV serves as an inter-agency mechanism for institutionalized implementation of export control policy, in line with legislative requirements and the formulation of rules and regulations on the export of controlled items. The Division has been designated as the licensing authority in respect of the goods, technologies, materials and equipment covered by the control lists and the implementation of the catch-all clause of the Export Control Act, 2004. The Strategic Export Control Division keeps the control lists under constant review, in accordance with the requirements of the Export Control Act, 2004. An oversight board to independently review the implementation of export controls has also been established.

The control lists adopted by Pakistan encompass the lists and scope of export controls maintained by the NSG, the London Suppliers Group, and the Australia Group, which relates to biological agents and toxins, and the Missile Technology Control Regime. The classification system is based on the European Union's integrated

list. Currently, Pakistan's Application for admission to NSG is pending, but in so far as the legal, regulatory and administrative requisites for NSG membership for non-NPT states are concerned, Pakistan no doubt is eminently qualified to join NSG and other global control regimes.

As a consequence of Pakistan not signing NPT, the legal obligations under the Articles II and III of NPT are not applicable upon it. Pakistan, therefore, possessed the legal freedom to develop its nuclear weapons program, with the United Nations unable to impose sanctions on it at any stage.

This necessity for acquiring nuclear weapons arose after India carried out a nuclear test in 1974 leaving Pakistan no option in the context of history and geo-politics of the sub-continent but to develop its own nuclear weapons. To that end, Pakistan worked covertly through a dedicated team of scientists without devising a legal framework as that would have effectively constituted a de facto legislative disclosure of its nuclear program and its outlines. The program continued quietly till 1998 when India carried out another series of explosions and Pakistan had to follow suit by successfully conducting its own nuclear tests on May 28, 1998, thereby making its acquisition of nuclear weapons overt to the entire world.

Almost immediately, on June 6, 1998, the United Nations Security Council (UNSC) passed Resolution 1172,[10] condemning both India and Pakistan for carrying out nuclear explosions.

Significantly, this Resolution must be read and understood in

conjunction and harmony with International Court of Justice's (ICJ) landmark Advisory Opinion of 1996 on the Legality of the Threat or Use of Nuclear Weapons. At the time the Opinion was rendered, I analyzed it in depth in a series of articles. The Court's decision, crucially, provides one of the few authoritative judicial decisions concerning the legality under international law of the use or the threatened use of nuclear weapons. The Court held that the threat or use of nuclear weapons may be lawful in an extreme circumstance of self-defense in which the very survival of a State would be at stake. It also identified international humanitarian law as *lex specialis* applicable in situations of armed conflict.

More recently in April 2014, Republic of Marshall Islands (RMI) filed a case in the ICJ against 9 nuclear weapons states including Pakistan for failure to comply with Article VI of NPT which calls upon member states to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament under effective international control. The case against Pakistan largely rested on exaggerated and unfounded legal grounds with respect to the jurisdiction of the Court and admissibility of the RMI's Application as well as substantive merits. Pakistan is not a member state of NPT and is thus not legally bound by it. Moreover, NPT's Article VI is clearly not an Erga Omnes norm under international law and therefore Pakistan is also not bound to give effect to Article VI as a customary international law obligation.

The RMI had originally filed Applications before the ICJ against all the nine nuclear-weapons states but only lawsuits against Pakistan, India and the United Kingdom proceeded to the jurisdiction stage as a consequence of their qualified advance consent to the Court's

jurisdiction.

In response to the RMI's written pleadings on issues of jurisdiction and admissibility, Pakistan's legal team, headed by me as Pakistan's co-counsel in the case and comprising another international law expert, Ali Sultan, submitted a detailed counter-response before the ICJ in the form of a Counter-Memorial stretching over 250 pages to argue the various grounds on the basis of which the case should not proceed to the merits.

Drafted pursuant to the rules and jurisprudence of the ICJ and strictly limited to preliminary issues of the Court's jurisdiction and admissibility of the RMI's application, Pakistan's Counter-Memorial emphasized that Pakistan's nuclear program is a matter of its national defense and security which falls exclusively within its domestic jurisdiction and is therefore not to be called into question by any court including the ICJ.

Moreover, it was conveyed to the Court that the RMI lacks the requisite standing to institute the current proceedings since there is no dispute, let alone a legal dispute, that exists between the RMI and Pakistan. This is manifested by the fact that the RMI has never suffered any damage caused by Pakistan either directly or indirectly, and by the lack of any formal or informal communication initiated by the RMI with Pakistan until it filed its application in the ICJ Registry.

Pakistan's written pleadings stressed that the injury claimed by the RMI cannot be redressed by compelling the specific performance in the absence of other nuclear-weapons states by only Pakistan,

which is neither "an interested party" nor a party "directly concerned" with obligations enshrined in the Nuclear Non-Proliferation Treaty (NPT).

Pakistan's Counter-Memorial further highlighted that the injury claimed by the RMI cannot be redressed by compelling the specific performance by only Pakistan, which is neither "an interested party" nor a party "directly concerned" with obligations enshrined in the NPT. It would be impossible for Pakistan to implement judgment for the RMI by fulfilling the responsibilities that would arise therefrom without the participation of all the NWS. Granting the relief sought by the RMI against Pakistan alone would, therefore, in the absence of other NWS willing to negotiate, be devoid of any practical legal effect.

For all these foregoing reasons, Pakistan submitted in its Counter-Memorial that the Court should adjudge and declare that the RMI's claims against Pakistan are neither within the jurisdiction of the Court and nor are admissible. In a landmark ruling in October 2016, the ICJ knocked out the RMI's case against Pakistan accepting Pakistan's legal arguments that it lacked the jurisdiction to proceed in the case any further on the merits. The ruling represents a historic first victory for Pakistan at the ICJ and formally brought the RMI lawsuit against Pakistan to a conclusion after two and a half years. While favorably responding to Pakistan's legal arguments, the Court in its judgment especially noted the lack of a legal dispute in the case and crucially affirmed through implication that Pakistan's nuclear weapons are not illegal under international law.

IV.

An especially turbulent development for Pakistan was the Dr. Abdul Qadeer Khan episode. Pakistan faced serious embarrassment at a global level given the allegations of loose controls over the individuals and materials relating to its nuclear program. It was portrayed as an irresponsible state. UNSC deliberated on the episode for several sessions and construed it as a grave threat to international peace and security, eventually adopting UNSC Resolution 1540.[11] A milestone in development of nuclear law, this Resolution, passed under Chapter VII of the UN Charter,[12] legally obliges Pakistan and all other UN member states to refrain from supporting non-State actors from developing, acquiring, manufacturing, possessing, transporting, transferring or using nuclear, chemical or biological weapons and their delivery systems.

The domestic legal fallout of the AQ Khan episode was also rattling for the state initially. A criminal FIR was filed against Dr. Khan and he was investigated along with some of his colleagues while the proceedings of their detention remained pending before the Supreme Court of Pakistan's review committee.[13]

UNSC Resolution 1540 clearly imposes positive obligations to prevent nuclear proliferation on every UN member state including Pakistan. This necessarily calls for the state to improve and upgrade its controls and restrictions with respect to individuals working for its nuclear program and also to undertake stern measures to protect its nuclear sites and materials.

UNSC Resolution 1540[14] includes a follow up implementing mechanism as well. It establishes a committee for non-

proliferation[15] comprising of 9 international experts.[16] The states are obligated to submit periodic reports to the committee to demonstrate their compliance with the Resolution. The reporting requirements are quite extensive and are submitted to the UNSC in a matrix form. Subsequently, UNSC has adopted Resolutions 1673 (2006), 1810 (2008),[17] 1977 (2011)[18] and 2055 (2012) to further strengthen the 1540 regime.

Thus far, to the complete approval and satisfaction of the 1540 Committee as well as independent think-tanks, in 2004 Pakistan submitted to the Committee its national report on the legislative, regulatory and administrative framework demonstrating its compliance with UNSC 1540 obligations. A comprehensive report in the form of a matrix was subsequently transmitted to the Committee in 2005, detailing the legal, regulatory and administrative measures relevant to the implementation of the specific provisions of UNSC 1540. Pakistan has also, through Notes Verbales, periodically updated the Committee about additional number of steps taken by it to further strengthen controls over goods, technologies, materials and equipment related to weapons of mass destruction and their means of delivery.

Coupled with the emergence of non-state actors involved in terrorist activities in the last decade, the A Q Khan episode also led to several multilateral initiatives aimed at criminalizing acts of nuclear terrorism and improving international coordination in preventing them. In this regard, a UN treaty, International Convention for the Suppression of Acts of Terrorism (Nuclear Terrorism Convention), came into force in 2005 to criminalize acts of nuclear terrorism and to promote police and judicial

cooperation to prevent, investigate, and punish those acts. Today, the Nuclear Terrorism Convention has 99 state parties. Pakistan and the United States, however, have not yet ratified it. The Nuclear Terrorism Convention supplements the Convention on the Physical Protection of Nuclear Material (CPPNM), adopted in 1979 in Vienna and acceded to by Pakistan in 2000, which provides for certain levels of physical transportation during international transport of nuclear material besides establishing a general framework for cooperation among states in the protection, recovery, and return of stolen nuclear material. CPPNM further lists certain serious offenses involving nuclear material which state parties are obligated to make punishable and for which offenders shall be subject to a system of extradition or submission for prosecution. Pakistan, in 2016, has also ratified the Amendment to the CPPNM and is now therefore a state party to the Convention on the Physical Protection of Nuclear Material and Facilities 2016 (CPPNMF).

Moreover, the Global Initiative to Combat Nuclear Terrorism (GICNT), a multilateral initiative launched in 2006, seeks to coordinate international efforts to detect, investigate, and respond to proliferation by non-state actors. Additionally, the US-led Proliferation Security Initiative (PSI), established in 2003, currently involves 98 states in developing best practices, joint training exercises, and information-sharing activities to enhance multilateral interdiction efforts. Importantly, however, PSI does not confer any legal authority for ship-boarding or interdiction beyond the UN Convention on the Law of the Sea Treaty and various bilateral arrangements, and PSI also cannot interdict ships of non-member states such as Pakistan unless master consents to

being boarded are specifically allowed.

V.

In the backdrop of these strengthening global non-proliferation mechanisms, it became imperative for Pakistan to enact a law that would not only act as an implementing body for UNSC Resolution 1540 but also provide the National Command Authority (NCA) an enhanced status as a statutory body with overarching powers to exercise complete control over all aspects of the country's nuclear program. NCA was notified in 2000 as a centralized entity by the Federal Government through an administrative measure to oversee the development of Pakistan nuclear program, with its coordination moves viewed as directions from the Federal Government to the statutory entity of PAEC.

Hence, in 2007, National Command Authority Ordinance was promulgated to provide enhanced legal coverage of security and safety measures on all matters concerning nuclear and space technologies, nuclear establishments, nuclear systems, nuclear materials, relevant personnel and related information, etc. It was re-issued in 2009 and in 2010 adopted by the Parliament as National Command Authority Act 2010[19] (NCA Act). NCA Act represents Pakistan's legislative response to demonstrate that it has full and complete legal powers over all aspects of its nuclear program including sites, materials and employees. It is thus a legislative assertion of Pakistan's policy with respect to control over its nuclear program.

The Parliament intended NCA to be absolutely independent

in its decision making, control over employees and protection of sites and projects etc. Therefore, in an extraordinary step, it omitted a customary provision from NCA Act included in most of the constituent statues of statutory bodies including PAEC and PNRA Ordinances, which enables directions from the Federal Government to be received and accepted. As there is no such provision in NCA Act, the directions of the Federal Government issued to other statutory bodies or departments are not binding on NCA, unless specifically adopted by it.

Headed by the Prime Minister, NCA is civilian controlled with Minister of Foreign Affairs, Minister of Defense, Minister of Finance, Minister of Interior, Chairman Joint Chiefs of Staff Committee, Chief of Army Staff, Chief of Naval Staff, and Chief of Air Staff as its members. As the elected head of the Federal Government, it is befitting for the Prime Minister to head NCA for he is inherently possessed of power under Article 245 of the Constitution to authorize use of force of any level or category on behalf of the Federation of Pakistan, including nuclear power.

The Strategic Plans Division headed by a serving Lieutenant General of the Armed Forces serves as the NCA's secretariat.[20]

Notably, NCA legislation is *sui generis* in many ways. It encapsulates the concept of strategic organizations and the administrative flexibility to bring them and their employees under the legal fold of NCA. Several statutory and non-statutory organizations are either mentioned in NCA Act as strategic organizations or have been attached through issuance of a notification.[21] Well known entities like NESCOM and AWC are notified under NCA Act and

are thus under the NCA's direct administrative control. Moreover, by virtue of application of NCA Act to existing statutory bodies like PAEC etc., the inconsistent provisions in earlier statutes such as PAEC stand impliedly repealed and overridden by it.

For NCA's employees, internal rules have been framed under NCA Act. Significantly, these rules ought to be seen as non-statutory since it was in this context that the language of the law was drafted in which no role has been assigned to the Federal Government to approve them. Thus, despite being called 'rules,' as of 2010 when NCA Act was enacted, they must be viewed as non-statutory on the basis of criterion set by the Supreme Court. To motivate NCA's employees, special grades have been introduced and improved facilities have been provided.

To deter any attempt of proliferation, NCA Act contains a special provision creating non-proliferation as an offence[22] and also provides a detailed prosecution mechanism for this offence. NCA Act, moreover, permits NCA to adopt any existing law with respect to any of its employees or operational aspects. This crucially permits NCA greater flexibility while providing framework for implementation of its decisions. It must also be noted that nuclear scientists and other personnel involved in Pakistan's nuclear program are separate from normal civil servants. While they may be in the service of Pakistan, given the nature and sensitivities of their functions, they are considered employees of the NCA.

In line with the powers and functions of the NCA, Section 7 of the NCA Act contains an enabling provision for creating an internal intelligence network to monitor the employees of NCA and other

threats against any nuclear installations or sites. It also serves as an enabling provision to raise specialized nuclear force which is specifically trained to handle all threats to nuclear material and facilities in Pakistan.

Addressing the 3rd Nuclear Security Summit at The Hague, Prime Minister Nawaz Sharif aptly reminded the world that Pakistan had been running a safe and secure nuclear program for over four decades with the expertise, manpower and infrastructure to produce civil nuclear energy. He also emphasized that international treaties and forums would supplement Pakistan's national actions to fortify nuclear security.

Perhaps most significantly, the Prime Minister underlined that today the country's nuclear security is domestically supported by five pillars – a strong command and control system led by the National Command Authority (NCA); an integrated intelligence system; a rigorous regulatory regime; a comprehensive export control regime; and active international cooperation.

Pakistan's domestic nuclear law framework adequately and robustly promotes these critical policy objectives to ensure Pakistan's status as a responsible nuclear weapons state.

Notes

[1]IAEA Statute, available at https://www.iaea.org/about/statute

[2]PEAC Ordinance 1965, Published in Pakistan Code 15 (1963-65) at page 390

[3]Ordinance VI of 1984, available at http://www.pnra.org/legal_basis/1984.pdf

[4]Ordinance III of 2001, available at http://www.pnra.org/legal_basis/Ordinance%202001(Amennded).pdf

[5]Nuclear Safety Convention, available at https://www.iaea.org/publications/documents/infcircs/convention-nuclear-safety

[6]Assistance in case of a nuclear accident or radiological emergency Convention, available at https://www.iaea.org/sites/default/files/infcirc336.pdf

[7]NPT Treaty, available at https://www.iaea.org/sites/default/files/publications/documents/infcircs/1970/infcirc140.pdf

[8]Ibid.

[9]Status of NPT parties, available at http://disarmament.un.org/treaties/t/npt

[10]S/RES/1172 (1998), available at http://www.un.org/en/ga/search/view_doc.asp?symbol=S/RES/1172(1998)

[11]S/RES/1540 (2004), available at http://www.un.org/en/ga/search/view_doc.asp?symbol=S/RES/1540(2004)

[12]UN Charter, available at http://www.un.org/en/documents/charter

[13]Later, there was litigation between the state and Dr. AQ Khan in the Islamabad High Court as well, which continued for several months.

[14]Ibid.

[15]Committee established pursuant to S/RES/1673 (2006), available at http://www.un.org/en/ga/search/view_doc.asp?symbol=S/RES/1673(2006)

[16]Group of experts pursuant to S/RES/2055(2012),available at http://www.un.org/en/ga/search/view_doc.asp?symbol=S/RES/2055(2012)

[17]S/RES/1810 (2008), available at http://www.un.org/en/ga/search/view_doc.asp?symbol=S/RES/1810(2008).

[18]S/RES/ 1977 (2011), available at http://www.un.org/en/ga/search/view_doc.asp?symbol=S/RES/1977%20(2011).

[19]NCA Act 2010, available at http://www.na.gov.pk/uploads/documents/1300934560_193.pdf

[20]Section 3 (5) of NCA Act, 2010.

[21]Section 8 of NCA Act, 2010.

[22]Section 12 of NCA Act, 2010.

CHAPTER: 4

PAKISTAN'S NUCLEAR COMMAND AND CONTROL

Adil Sultan

Introduction

The evolution of Pakistan's nuclear program and the development of its management structure is an interesting case study. A country with limited resources and technological base that continues to face several security challenges - both conventional and unconventional, reluctantly entered into complex nuclear business and was able to build nuclear weapons without violating any of its international obligations. As the nuclear program moved towards operationalization post May 98 nuclear tests, the corresponding nuclear management structure also evolved that not only provided the desired continuity to the development goals, but also ensured the credibility of nuclear deterrence in the face of new and emerging challenges.

Pakistan's nuclear management moved from an informal arrangement during the initial period to a fully functional command and control structure that now oversees all aspects of country's nuclear program. This evolution in the management structure can be divided into five different phases and covers the entire spectrum of activities, including: nuclear weapons, peaceful nuclear applications, and safety and security regime.

This chapter aims to provide a brief history of nuclear management structure in the pre and the post 1998 periods, covering salient features of nuclear safety and security regime, without going into technical details that have been covered in a separate chapter. Drawing comparison with the Cold War period, the chapter then discusses command and control of nuclear weapons in Pakistan in the backdrop of Peter Feaver's 'assertive/ delegative' model and the theoretical framework provided by Scott Sagan. Finally, a brief analysis of ongoing debate within India on possible revision of its 'No First Use' (NFU) posture and its likely implications on Pakistan's nuclear posture has been discussed.

Evolution of Pakistan's Nuclear Management Structure

It is well known that Pakistan started its nuclear journey in early 1950s. As one of the earliest beneficiaries of the 1953 US *Atoms for Peace* initiative[1], launched by President Eisenhower, Pakistan initiated its nuclear research program that was modest due to limited financial resources, lack of infrastructure and technical expertise available within the country. The nuclear program that was primarily oriented to benefit from peaceful applications of nuclear technology, however, changed its course towards

development of nuclear weapons option, once India decided to carry out its first nuclear weapon test in 1974.

This change in orientation was guided primarily by security considerations, and received the desired momentum due to personal interest of Mr Zulfiqar Ali Bhutto, who had emerged as a strong nationalist leader after the 1971 war with India. Pakistan's nuclear management structure during initial years of the nuclear journey mostly remained informal and personality oriented. This however, gradually transformed into an institutionalized command structure, once Pakistan decided to formally declare itself as a nuclear weapons state in 1998.

The history of Pakistan's nuclear program and its management structure could be divided into five different phases. First phase of the nuclear program started in the mid-1950s and lasted till 1971. Since the nuclear program had only peaceful orientation, it was, therefore, managed by the Pakistan Atomic Energy Commission during its formative phase. The second phase of the nuclear program started after 1971 war with India that resulted into Pakistan's dismemberment. This debacle completely transformed national priorities and acquisition of nuclear weapons became one of the primary objectives.

Third phase of the nuclear program started in 1977 when General Zia took over as President and along with it the management of the nuclear program. This phase culminated with his death in 1988 and coincided with the end of the Cold War in 1989, which saw Pakistan's reduced salience as a front line US ally. Starting from 1990 up to 1998 is the fourth phase, during which Pakistan

moved from 'nuclear ambiguity' to 'nuclear opacity'[2], as existence of nuclear weapons program was publicly acknowledged and the remaining ambiguity, if any, about nuclear weapons was finally over. The fifth and final phase could be categorized as the post-1998 nuclearization period, during which Pakistan formally declared itself as nuclear weapon state and consolidated its command and control structure.

Phase-I (1954-1971)

As part of Atoms for Peace initiative, the US organized a road show in various developing countries, including Pakistan, to introduce the benefits of peaceful nuclear technology. This generated considerable interest amongst general public and within the government circles. To benefit from this new technology, the Government of Pakistan, in 1956, decided to establish Atomic Energy Council (AEC), which was later renamed as Pakistan Atomic Energy Commission (PAEC).

PAEC being the primary manager of nuclear program developed initial plans that were quite modest. It included a nuclear research reactor that was to be completed in 1960 but even this could not materialize due to lack of resources and bureaucratic hurdles.[3] Zulfiqar Ali Bhutto, who had joined President Ayub's cabinet as Minister for Fuel, Power and Natural Resources in 1958, emerged as a staunch supporter of the nuclear program and provided much needed stewardship that helped build a strong base for the future.

Bhutto's passion for nuclear technology was not without a reason. He was convinced that if India acquired a bomb this would

perpetuate Indian hegemony in the region. Therefore, the only way to avoid this undesirable outcome was to build own indigenous deterrence capability and reduce dependence on external security guarantees. Bhutto's apprehension was further reinforced by statements emanating from senior Indian scientists, including Homi J Bhabha – the father of India's nuclear program, who had declared in 1958 that India could produce a nuclear device 'in eighteen months', subject to the approval by political leadership. Whether India had the potential to build a bomb in 1958, or not, but such statements by responsible positions holders reinforced Pakistan's apprehensions about India's dual track nuclear program, which were vindicated when India decided to conduct its first nuclear weapon test in 1974.

As one of the leading proponents of developing nuclear weapons, Bhutto had to face strong resistance from his own cabinet colleagues in the government,[4] since several of them were of the opinion that acquisition of nuclear weapons was not only difficult, but also unnecessary. Some also believed that alliance partnership with the US provided sufficient security guarantees, and therefore, pursuing a nuclear path may not be required. These assertions were proven wrong, as US failed to assist Pakistan during 1971 war with India that eventually led to Pakistan's dismemberment.

During this initial period of nuclear journey Pakistan did not have a formal nuclear management structure. The focus was primarily on capacity building and training of scientists. Large numbers of scientists were sent abroad for training, majority of whom on their return helped lay a strong foundation for Pakistan's nuclear program.

Phase-II (1972-1977)

The loss of East Pakistan and a humiliating military defeat at the hands of India in 1971 provided adequate justification to shift the orientation of Pakistan's nuclear program from being purely peaceful to a military oriented program. After coming into power in 1972, Bhutto made several administrative adjustments and personally took charge of nuclear affairs. A separate Ministry of Science, Technology and Production was established and an inter-ministerial committee was set up to manage the nuclear affairs. Chairman PAEC became directly answerable to the Chief Executive of the country to help overcome bureaucratic delays and fast track the nuclear weapons program.

In March 1972, Bhutto replaced I.H. Usmani and appointed Munir Ahmed Khan as the new Chairman of the PAEC, since Usmani was less enthusiastic about the military applications of nuclear technology.[5] Nevertheless, Usmani had played an important role in building sizeable human resource by sending large number of scientists to technologically advanced countries. This pool of foreign trained scientists and engineers became instrumental in leading the nuclear program.

During this phase, the nuclear program remained under a personalized control with different heads of scientific commissions reporting directly to the Prime Minister without any institutionalized decision-making structure. The inter-ministerial committee that had senior ministers, bureaucrats and scientists was responsible for implementing Bhutto's directives that played the role of 'political father' to the Pakistani bomb.[6]

Phase-III (1977-1989)

The third phase of the nuclear program started with Bhutto's removal from power and imposition of Martial Law in 1977. Consequently, General Zia ul Haq, who was the Army Chief and Chief Martial Law Administrator, also became the President. Zia nevertheless, continued with the informal structure that was put in place by Bhutto, but preferred to maintain ambiguity about the scope and objectives of the nuclear program.

The Soviet invasion of Afghanistan in 1979 and Pakistan's pivotal role as a front line state helped Zia to withstand international pressures. Eager to gain Pakistan's support, the United States willingly offered assurances that it will not interfere in Pakistan's nuclear program.[7] In order to facilitate the flow of military and economic assistance and to satisfy the Congress, the US President even provided periodic certifications about the peaceful nature of Pakistan's nuclear program.

After Zia's death in a plane crash in 1988, General Aslam Beg took over as the Army Chief and Ghulam Ishaq Khan became the President of the country. President Ghulam Ishaq Khan involved General Aslam Beg in nuclear policy related decisions. Later on, Benazir Bhutto who had become Prime Minister in November 1988 also became a part of the nuclear decision making arrangement which also included the heads of PAEC and KRL. This, however, was an informal forum and was not a substitute for a formal command and control structure[8], as later claimed by General Beg and was only meant to review and sanction the development of various nuclear projects.

Phase-IV (1990-1998)

The end of Afghan war in 1989 reduced Pakistan's salience for the Western powers. The US not only withdrew economic and military support but also refused to provide annual certifications about 'peaceful' nature of Pakistan's nuclear program. This eventually led to re-imposition of sanctions and Pakistan was left on its own to clear the mess created by the Afghan war that continues to threaten its internal security. In 1993, President Clinton's initiative to cap, reduce and eliminate all weapons of mass destruction and ballistic missile system from the region,[9] led to further pressures on Pakistan's nuclear program.

This period was also marked by quick political transitions within the country that saw different governments being removed in quick succession. In order to provide continuity to the nuclear program, the Army tasked the Combat Development Directorate at GHQ, to monitor and coordinate the activities of the strategic organizations during General Waheed Kakar's tenure as the COAS. The CD Directorate continued to coordinate all nuclear related issues with the strategic organizations till the establishment of National Command Authority (NCA) in 1999.

Phase V – Post 1998

After the nuclear tests of 1998, Pakistan formally declared itself as a nuclear weapon state. This new status brought additional responsibilities as well as challenges, and therefore required institutionalized management structure to oversee operationalization of the newly acquired nuclear weapons capability.

To deal with operational matters and associated command and control related issues, Prime Minister Nawaz Sharif was presented with a new organizational structure in April 1999. However, PM Sharif's government could not last long and was removed from power in October 1999. After coming to power, General Pervez Musharraf accorded high priority to the subject and formally approved the nuclear command and control structure in February 2000.

Command and Control of Nuclear Weapons

Command and Control (C2) are two distinct but related disciplines of art and science that could best be understood through interrelationship of what is being hypothesized at the core or the leadership level (intangible) and the facts at the operational level (tangible). Together, the primary purpose of C2 is to achieve defined objective(s) through efficient channelization of available means and resources.

C2 can be described as: "The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission …"[10] This definition deals mainly with the conventional military that has the primary aim to prepare and win wars. Nuclear C2 on the other hand, must work towards strengthening of deterrence with the main objective of war prevention, while preparing for the possibility of a nuclear use. Unlike the conventional C2 that can be gauged by the outcome of a war; the efficacy of nuclear C2 would be judged through the accomplishment of its primary mission i.e. to prevent war.

Theory and the Nuclear Command & Control (C2) Structures

National command and control structures are shaped as per the prevalent strategic culture and would therefore be distinctly different in most nuclear weapon states. Due to the sensitivities associated with nuclear C2 related issues, most states remain reluctant to provide complete transparency about their decision making models. Scholars like Scott Sagan have tried to offer a theoretical framework that could possibly influence national nuclear doctrines.[11] This model could also be studied to understand the nature of nuclear C2 that a nuclear state would like to develop.

The theory of *realism* as explained by Sagan and other scholars stipulates that states develop their power potential, including nuclear weapons, to safeguard national security interests against external threat(s). If the primary driver for acquiring nuclear weapons is indeed a 'security' consideration, it is more likely that the state would develop its nuclear C2 structure that is more robust, workable as per state's unique strategic culture, and offer a degree of transparency to ensure the credibility of deterrence. On the contrary, if a state has developed nuclear capability mainly for 'prestige'; there is likelihood that the C2 structure would be ambiguous and could lack coherence.

Second, *organization theory* is also a useful tool to understand the influence of institutions and interest groups in developing C2 structure. It is natural for different organizations and institutions to expand their influence and strive for more resources; however, if C2 is balanced and integrates all important national stakeholders, including political leadership, military, scientists and the civilian bureaucracy, the likelihood of a single organization dominating

decision making process could be considerably reduced. Pakistan's C2 structure as discussed earlier embodies most of these elements thus reducing the likelihood of internal friction. On the contrary, India's nuclear C2 has several inconsistencies.

Notwithstanding repeated reiterations by India of a civilian led nuclear C2 structure, analysis of India's C2 system reveals that there is inherent conflict amongst its strategic enclave. While political leadership continues to maintain morally defensible and politically expedient positions, India's scientific community, on the other hand, seems to be moving on a completely different trajectory. DRDO (Defense Research and Development Organization), which enjoys overwhelming influence in India's nuclear decision making, is developing systems that do not support India's declaratory positions of 'Credible Minimum Deterrence' (CMD) and 'No First Use' (NFU) doctrine. Likewise, Indian military that remains outside nuclear decision making process, is preparing for fighting a limited conventional war through its Cold Start Doctrine (CSD), without realizing that any conflict between two nuclear armed states could spiral into an all-out war with the possibility of a nuclear use. These inconsistencies reflected through conflicting declarations made by India's principal stakeholders do not bode well for regional stability, as it could add pressure on Pakistan's decision makers as well.

Third, is the theory of *National Strategic Culture*, which explains the influence of history, national experiences, traditions, democratic values, role of institutions, etc., on the C2 structure that a country is likely to establish to meet its security requirements. Due to peculiar nature of military rivalry with

India, Pakistan had to develop a nuclear command structure that is more realistic and robust, to deal with the current and emerging challenges. Occasional cynicism on Pakistan's nuclear command structure and military's overwhelming influence is based on lack of understanding of Pakistan's peculiar strategic culture, where military has an important role in national security affairs but not necessarily holds overriding influence in nuclear decision making process, which falls under the ambit of NCA with the Prime Minister as its Chairman.

Theory of *Global Strategic Culture* is also a useful framework to understand the nature of a C2 structure. According to this, smaller nuclear powers tend to emulate bigger powers in their behavior, which is called 'isomorphism'. Since the Cold War experience is a useful model to learn from and develop nuclear management structures; both India and Pakistan may have used it to develop their own nuclear learning curves without reinventing new theories. Nevertheless, it is not necessary that all of the lessons drawn from the Cold War period would be applicable in the South Asian regional environment, as both models have significant differences.

Lessons from the Cold War

Besides the theoretical model discussed above, it may be useful to analyze key characteristics of nuclear management models used by the former Soviet Union and the US. Some of the similarities and differences being identified would help better understand why all lessons from the Cold War period may not be applicable to the South Asian environment.

One of the key differences between the Cold War competition and South Asian nuclear rivalry is the difference in scope and objectives for developing nuclear weapons. During Cold War, both Super Powers struggled to compete for global dominance and accordingly developed capabilities and associated command and control structures that had extended reach with an objective to provide security guarantees to their alliance partners. On the other hand, South Asian nuclear competition is limited in its scope and orientation at least in the foreseeable future, which may however change once India builds its military capabilities further and expands its security interests beyond its immediate neighborhood. Until then, both regional neighbors are likely to maintain their respective nuclear capabilities at levels that are modest in comparison to the Cold War model.

Unlike the former Soviet Union and US, where both super powers were engaged in proxy wars on other Continents without risking nuclear exchange against each other's mainland; India and Pakistan do not enjoy this spatial luxury. A military crisis between the two South Asian neighbors could spiral into an all-out war and may lead to nuclear exchange with serious consequences for both the adversaries. This would remain an important, albeit not the only consideration for the decision makers on both sides, before contemplating nuclear use against each other. Nuclear C2 structures established by both the countries would have to cater for these limitations.

Both the Super Powers, at the peak of their rivalry maintained higher alert levels and 'launch on warning' postures, to ensure a matching response within a limited reaction time. This is not

the case in South Asia as of now, but could change once India operationalizes its cannisterized missile systems, to 'reduce the reaction time of its missiles to within minutes.'[12] Pakistan on the other hand seems to have no such compulsion to maintain higher alert levels, as long as India continues to maintain its existing posture of recessed deterrence. However, the on-going debate within India to review its NFU policy could bring pressure on Pakistan's C2 system, as it may have to take corrective measures to reduce the 'perceived incentive' for India to launch counter force pre-emptive 'first strike' against Pakistan.[13]

An important lesson from the Cold War that may also be applicable to South Asia is that as the technologies grow there could be increased propensity to move from highly 'assertive' to a 'delegative' command and control structure. For example, after the introduction of submarine based capability, it may be necessary to pre-delegate control of nuclear weapons, to allow autonomy to the local commander to take a decision in case of a communication breakdown. Such challenges are likely to be confronted by both South Asian neighbors once they venture into the new domain and expand their nuclear capabilities.

Typology of Nuclear Command and Control

The primary function of institutionalizing nuclear command and control structure is to ensure the credibility of a state's nuclear deterrence posture and give confidence to the national leadership that nuclear weapons would always be available for employment when needed, and would never be used unless authorized by the leadership. This *always/ never* paradox is summed up by Peter

Fever:

> Weapons must be reliable: unlikely to fail at the moment when leaders want to use them; safe: unlikely to detonate accidentally; and secure: resistant to efforts by unauthorized people to detonate them.[14]

Always/ Never dilemma, also known as positive/ negative control identifies a state's preference to maintain 'delegative' or 'assertive' command and control over its nuclear weapons. If the intent of the leadership was to ensure a positive response against a potential pre-emptive strike by the adversary, there would be a greater inclination to pre-delegate launch authority to the local field commanders and also to maintain nuclear weapons on higher alert level. This could risk unauthorized launch in the fog of war in case of a communication breakdown.

If the leadership is confident about an assured response even after a pre-emptive strike, there would be lesser temptation to pre-delegate launch authority, thus preferring to maintain an assertive control. This reduces the incentive to keep delivery systems on high alert or mating of warheads before these are needed, and therefore reduces the chances of an unauthorized launch, but at the same time increases the likelihood of weapons becoming 'fail-safe' or 'impotent', as nuclear weapons may not be able to play their desired role in a crisis.

Comparison of Delegative and Assertive Command Systems		
	Delegative	**Assertive**
	Relatively high autonomy given to lower commanders	Minimal autonomy given to lower commanders
Measures used to assure obedience	Minimal	Extensive
	Limited administrative measures De facto reliance upon military obedience to civilians	Wide use of administrative and physical use-control measures Military obedience to civilians enforced by specific measures
Custody and stockpile arrangements	Operators given custody and allowed to deploy at relatively high states of readiness	Weapons not assembled If assembled, kept separate from delivery system If co-located, some physical measures to separate control of possession from ability to use
Protects against failure mode	Decapitation Fail deadly	Accidental and unauthorized use Fail impotent or fail safe

Source: Peter D. Feaver, Command and Control in Emerging Nuclear Nations

In the India-Pakistan scenario, since neither of the two adversaries has the potential for a decapitating pre-emptive strike, it reduces

the incentive to keep the weapons on hair trigger alert. This may however change with India putting its missiles on higher alert levels as was earlier signaled by its former DRDO Chief,[15] or else it decides to review its No First Use (NFU) posture and considers pre-emptive 'First Strike' option against Pakistan. The possibility of this change cannot be ruled out keeping in view the on-going criticism within India about the credibility of India's existing nuclear posture in the aftermath of Pakistan's decision to introduce its SRBM 'Nasr'.[16]

Defending India's current nuclear posture and to pacify growing internal discord, several of the former Indian senior officials have discarded the possibility of any change in India's declaratory policies, while maintaining ambiguity about India's actual nuclear use doctrine. India's Chairman of National Security Advisory Board (NSAB), in his policy statement of 2013 stated that while India formally adopted its nuclear doctrine in Jan 2003, "but its full text has not been shared with the public."[17] Similarly, India's former National Security Advisor (NSA), Shiv Shankar Menon, in his recently published memoir wrote: "There is a potential grey area as to when India would use nuclear weapons first."[18]

These statements indicate the possibility of serious consideration within the policy circles to review India's nuclear doctrine. Menon's reference to a 'potential grey area' has led some analysts to conclude that India may be in the process of reviewing its NFU posture and could contemplate counter force pre-emptive 'first strike' against Pakistan.[19] This coercive deterrence strategy could possibly be aimed at restoring the credibility of India's conventional as well as nuclear deterrence that has been under

scrutiny after Pakistan's introduction of SRBMs, which has not only neutralized India's Cold Start Doctrine (CSD) but has also brought into question India's doctrine of 'massive retaliation'.

Notwithstanding the on-going conceptual debate, India at present does not have the requisite ISR (Intelligence, Surveillance, and Reconnaissance) capability to locate and neutralize Pakistan's nuclear inventory, in a pre-emptive counter-force first strike against Pakistan. Even if India builds a credible ISR capability with the outside assistance, it would be extremely dangerous for India to contemplate a pre-emptive 'first strike', as it could lead to an all-out nuclear exchange with the possibility of mutually assured destruction. Moreover, the change in posture could also bring pressure on Pakistan to review its control of nuclear weapons pushing it from 'assertive' to the other end of the spectrum, since it would not like to be faced with a 'use it or lose it dilemma'.

Some of the critics of 'Nasr' SRBMs are of the view that Pakistan may have already moved towards a 'delegative' control and these weapons could be handed over to a local battlefield commander during a military crisis. These concerns are mostly based on lack of information and also a result of disinformation by the detractors of Pakistan's nuclear capability.

Pakistan's nuclear command and control structure does not envision pre-delegation of any weapon system, including its SRBMs 'Nasr'. Since all three strategic forces are separate from conventional forces and under the direct operational control of the NCA, therefore, there is no possibility of nuclear weapons being handed over to a local battlefield commander who would

mainly be charged with conventional military operations. The authorization to mobilize, deploy or employ all strategic assets, including the TNWs, rests solely with the NCA, and no pre-delegation is envisaged as per the statements by Pakistan's senior decision makers.

Another concern about SRBMs is that these weapons could come into play very early at the start of a military crisis thus compressing the nuclear escalation ladder. This hypothesis however, does not cater for the conventional responses that are being developed to deal with India's CSD, in the form of Azm-i-Nau exercises that Pakistan conducts and publicizes regularly.

Pakistan's Nuclear Management Structure

Pakistan's existing nuclear management is a multi-tiered institutionalized structure that involves all relevant national stakeholders, including the political leadership, military and the scientists who are responsible for development of various systems.

Tier 1 - National Command Authority (NCA)

The NCA is an overarching body that comprises senior political and military leadership of the country and is headed by the prime minister. It has two committees - Employment Control Committee (ECC) and the Development Control Committee (DCC).

The Foreign Minister is the Deputy Chairman of the ECC and other members include the defense, interior and finance Ministers. The military side is represented by the Chairman Joint Chief of Staff Committee (CJCSC), Chief of Army Staff (COAS), Chief of

Naval Staff (CNS) and Chief of Air Staff (CAS). DG SPD acts as the Secretary. ECC being a politico-military body is responsible for formulating nuclear policy and controls all aspects of Pakistan's nuclear capability including deployment and, if ever necessary, the use or employment of strategic systems. Broad functions of the ECC include:

- Review of the threat environment
- Development of doctrinal concepts in line with the strategic environment
- Guidelines for the development of strategic weapons program
- Deployment and employment of tri-services strategic forces during crises
- Maintaining an effective command and control system to safeguard against accidental or unauthorized use, and for the safety and security of all nuclear assets
- Formulate national positions on various arms control issues

The Development Control Committee (DCC) is also a subsidiary body of the NCA, led by the CJCSC as its Deputy Chairman. Other members of the DCC include COAS, CNS, CAS besides Heads of the constituent scientific organizations. The DCC being a techno-military body is responsible for developing systems as per the decisions taken by the ECC. Broad functions of the DCC include:

- Implementation of the policies and decisions taken by the ECC
- Exercise day to day technical, financial and administrative control over strategic organizations

- Development of strategic weapons systems as per the approved development strategy

Tier 2 - Strategic Plans Division (SPD)

SPD is the Secretariat of the NCA and is responsible for developing and managing all aspects of Pakistan's nuclear capability, including: operations and plans, weapons development, arms control, command and control related issues, safety and security, budget etc. As the Secretariat of the NCA, SPD works directly under the Prime Minister and the Chairman Joint Chiefs of Staff Committee through Director General SPD who is a three star officer from the army. Some of the major tasks that are performed at the SPD on behalf of the NCA include: -

- Development of national nuclear policy, strategy and doctrine.
- Short and long term force development strategy for tri-services strategic forces, within the ambit of national power potential, nuclear doctrine and arms control regimes, and oversee its implementation
- Formulation of strategic and operational plans at joint services level for the deployment and employment of strategic forces
- Assist the prime minister and the CJCSC in exercising control over strategic organizations, and coordinate financial, technical, developmental, and administrative aspects
- Provide input and coordinate positions with Ministry of Foreign Affairs on various arms control related issues

Tier 3 – Strategic Force Commands

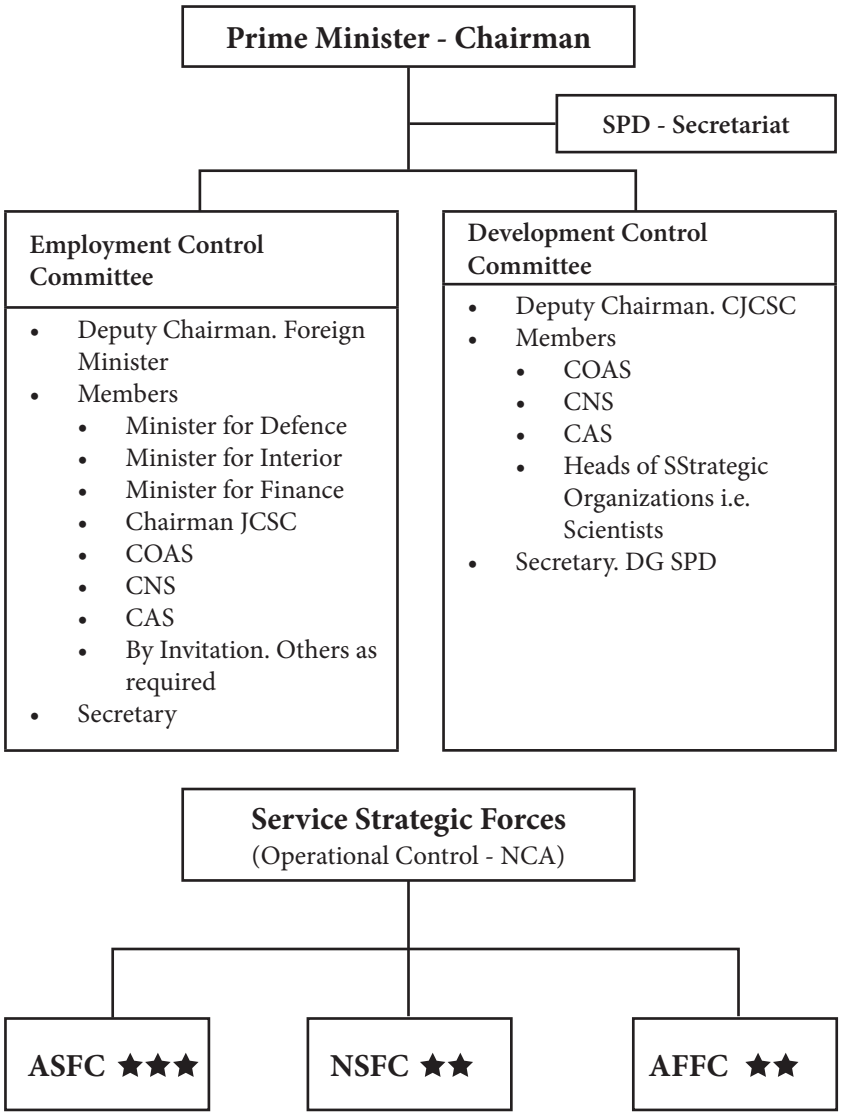
The three military services, army, air force and the navy have

their own Strategic Force Commands (SFCs) that are separate from the conventional forces. While the armed services retain training, technical and administrative control over their respective strategic forces, the operational planning and control, including deployment and launch authority rests entirely with the NCA under the guidance of the prime minister. As the Secretariat of the NCA, SPD coordinates all operational and other related aspects with the three services headquarters.

Tier 4 – Strategic Organizations/ Commissions

The strategic commissions responsible for development of various systems are part of the NCA. These include Pakistan Atomic Energy Commission (PAEC), National Engineering and Scientific Commission (NESCOM), Space and Upper Atmosphere Research Commission (SUPARCO) and Khan Research Laboratories (KRL). All these constituent organizations work as per the direction of the DCC and goals set by the ECC.

ORGANIZATION OF NCA



CONCLUSION

Pakistan's nuclear program has been the focus of interest for the international community since its inception. After nuclearization of South Asia, concerns about Pakistan's ability to manage its nuclear affairs led to several myths and misperceptions that were essentially politically oriented and intended to limit Pakistan's nuclear development.

Pakistan's unique institutional arrangement to oversee nuclear program is reflective of prevailing strategic culture and has worked well during previous crises. Inclusion of all important stakeholders in the nuclear decision making process: the political leadership; military; and the scientific establishment, has helped achieve national goals with a focused approach and in a relatively short period of time. This arrangement has also been successful to meet various diplomatic challenges in the form of various initiatives launched by major powers that continue to impact relatively new nuclear powers, especially countries like Pakistan.

Pakistan's nuclear command and control structure remains centralized and geared towards a highly assertive spectrum of decision making for several reasons. Creation of dedicated and separate strategic forces under the direct operational control of the NCA helps ensure that the decision to introduce nuclear weapons during a military crisis rests with the senior national leadership of NCA and not with the local battlefield commanders leading the conventional forces.

Pakistan's C2 has evolved from an informal to a highly institutionalized decision making structure. Despite odds, Pakistan

has managed to maintain credibility of its nuclear deterrence by developing solutions to deal with perpetual existential threat emanating from its eastern neighbor. Integration of all relevant national stakeholders has also helped build unmitigated consensus on the country's nuclear program, which is seen as the guarantor of national security against all possible external threats.

Notes

[1]US Department of State, *Documents on Disarmament, 1945-59* (Washington D.C. Department of State Publication, 1960), pp.393-400.

[2]Nuclear 'ambiguity' has been differentiated from 'opacity' by some scholars. In the first instance, state's decision whether to pursue the nuclear option remains ambiguous, whereas, in the second case a state is believed to have acquired nuclear weapons but has yet not made a formal declaration, e.g. Israel's case could be seen as opaque proliferation.

[3]Naeem Salik, *The Genesis of South Asian Deterrence: Pakistan's Perspective,* (Karachi: Oxford University Press, 2009), p.74.

[4]Zulfiqar Ali Bhutto, *If I am Assassinated,* (New Delhi: Vikas Publishing House Pvt. Ltd, 1979), p.137.

[5]Quoted in Bhumitra Chakma, *Pakistan's Nuclear Weapons,* (New York: Routledge, 2009), p.139.

[6]Feroz Hassan Khan, "Political Transitions and Nuclear Management in Pakistan", *Nonproliferation Policy Education Center (NPEC)*, p.154. Available at http://www.npolicy.org

[7]K.M. Arif, *Working with Zia: Pakistan's Power Politics,* (Karachi: Oxford Press, 1995), p.346.

[8]Quoted in Naeem Salik, *Learning to Live with the Bomb, Pakistan: 1998-2016*, (Karachi: Oxford University Press, 2017), p.147.

[9]Chakma, op.cit., p. 31.

[10]Defense Technical Information Center. DoD dictionary of Military and Associated Terms, Joint Publication.

[11]For detailed study see, Scott D. Sagan, (eds.) *Inside Nuclear South Asia*, (Stanford Security Studies: 2009)

[12]"New Chief of India's military research complex reveals brave new mandate", *India Today,* 3 July 2013. Available at <http://indiatoday.intoday.in/story/indias-nuclear-counterstrike-response-time-to-be-in-minutes-drdo-chief/1/286691.html>

[13]Max Fisher, "India, Long at Odds With Pakistan, May Be Rethinking Nuclear First Strikes", *The New York Times*, 31st March 2017.

[14]For details see, Peter D. Feaver, "Command and Control in Emerging Nuclear Nations," *International Security,* Volume 17, No. 3 (Winter 1992/ 93), p.163.

[15]"New Chief of India's military research complex reveals brave new mandate", *India Today*, 13 July 2013. Available at: http://indiatoday.intoday.in/story/indias-nuclear-counterstrike-response-time-to-be-in-minutes-drdo-chief/1/286691.htmlaaa.

[16]"India's Nuclear Doctrine: An Alternative Blueprint", *Institute of Peace and Conflict Studies* (IPCS), 2012. Available at www.nuclearsecurityproject.org.

[17]Shyam Saran, "Is India's Nuclear Deterrent Credible?", Speech delivered at India Habitat Centre, New Delhi, April 24, 2013. Available at www.armscontrolwonk.com.

[18]Max Fisher, "India, Long at Odds With Pakistan, May Be Rethinking Nuclear First Strikes", *The New York Times*, 31st March 2017.

[19]Max Fisher, "India, Long at Odds With Pakistan, May Be Rethinking Nuclear First Strikes", *The New York Times*, 31st March 2017.

CHAPTER: 5

THE SAFETY AND SECURITY CHALLENGES AND RESPONSE

Naeem Salik

In recent times nuclear 'security' has occupied the center stage in the international arena most vividly manifested in the form of the recently concluded Nuclear Security Summit (NSS) process initiated by President Obama. The four iterations of NSS between 2010 and 2016 involving highest political leadership of 53 countries including Pakistan and relevant international organizations have helped sensitize them to the critical need for individual as well as collective efforts towards the achievement of optimum levels of nuclear security.[1] The considerable gains made during the NSS process will hopefully be further consolidated and carried forward by the participating nations along with some other countries, which were not invited to participate in the summit process, with the assistance of the IAEA.

Maintenance of highest possible standards of safety and security is an essential pre-requisite for nuclear technology as is the case with other hazardous technologies involving the chemical, biological and radiological substances. The consequences of an accident involving nuclear materials at a nuclear installation or during transit or storage would be wide ranging and long lasting for both the humans and the environment. Similarly, pilferage of nuclear materials from manufacturing plants, storage facilities or during transit as well as deliberate mala-fide actions causing the spread of radioactive materials from nuclear facilities or transport carrying special nuclear materials can have disastrous effects. Luckily such accidents have been a rarity with the exception of the 'Three Miles Island'[2] incident in the United States, the 'Chernobyl'[3] disaster in the former Soviet Union and more recently the 'Fukushima' accident in Japan.[4] Analysts dealing with nuclear safety and security issues have propounded two competing theories i.e. 'The High Reliability Theory,' and the 'Normal Accidents Theory.' While the proponents of 'high reliability theory' believe that hazardous technologies such as the nuclear technology can be safely operated through appropriate organizational structures and effective management procedures,[5] the exponents of 'normal accidents theory' argue that accidents are bound to happen sooner or later in complex technological systems due to tight coupling and close proximity of hazardous materials and equipment. The chances of accidents in their view are further compounded due to lack of understanding of complex processes by the management, lack of continuity and uneven levels of competence amongst the decision makers and external political and societal influences.[6] However, there is not much empirical evidence to support their contentions and they have themselves conceded that the safety

record of nuclear industry has been exceptionally good.

In the literature on the subject of nuclear safety and security the two terms are usually used interchangeably and in some cases where only 'safety' is used it is meant to denote both safety and security. The two terms are in fact complementary to each other as is evident from the IAEA's definitions of the terms. IAEA in its Glossary of Concepts and Terms has defined 'safety' as:

> Safety is the achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards… Safety concerns both risks under normal circumstances and risks as a consequence of incidents, as well as other possible direct consequences of a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation.[7]

The same glossary has defined nuclear 'security' as:

> Nuclear Security is the prevention and detection of, and response to theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities.[8]

Nuclear Safety and Security in Pakistan

No other nuclear country in the world has had to endure the kind of cynicism, doubts and concerns about the safety and security of its nuclear assets and no other country has had to perpetually strive to explain the viability of its safety and security systems and its commitment to ensure the maintenance of internationally

recognized standards as Pakistan. There is a familiar cyclic pattern to media hype on this issue usually triggered by a 'leaked' story in a leading newspaper and is repeated a few times every year giving way to articles published by some of the world's leading think tanks and culminating in often contradictory comments by officials. There are several reasons for this. First, Pakistan started pursuing its nuclear weapons program at a time when NPT had entered into force and an international norm against horizontal proliferation was taking roots. Second, India's nuclear test in May 1974 made matters worse with the tightening of controls over nuclear and dual use technologies. Third, Pakistan's efforts to find a way around these newly erected barriers and to exploit the remaining loopholes in the system were not viewed very kindly by the international community and the surreptitious manner of its acquisition of technology from the nuclear black markets associated a kind of illegitimacy with its program. Unfortunately for Pakistan the titles of the earliest books and television documentaries about its program unfairly termed its program as the 'Islamic Bomb' and presented it as a threat to Israel thereby bringing together the pro-Israeli, anti-proliferation and Indian lobbies in its opposition. In more recent times the chaotic internal security situation as a spillover of the US led invasion of neighboring Afghanistan after 9/11 and the revelations of the indiscretions of the AQ Khan network have provided added reasons for fear mongering and speculation. Unfortunately for Pakistan long after the dismantling of the proliferation network the stigma refuses to go way and continues to haunt. It was used by President George W. Bush to silence Pakistan when it demanded a nuclear cooperation agreement similar to the one being offered to India and has since been used to malign Pakistan

periodically by the Western media, think tanks and lobbyists. The stereotypes and clichés used to express fears and concerns about nuclear security in Pakistan are well worn out and simply ignore the enormous resources that Pakistan has invested in developing and implementing a comprehensive nuclear security architecture that has won the admiration of the IAEA as well as respected institutions such as Nuclear Threat Initiative (NTI).

Evolution of the Nuclear Security Regime in Pakistan

As mentioned earlier the very nature of the Pakistani nuclear program and the international opprobrium it attracted meant that Pakistan was compelled to keep its pursuit of nuclear weapons covert. The significance of secrecy for the ultimate success of the effort was such that it undermined security and ruled out any external audit or oversight of the activities of various strategic organizations. The emphasis was on keeping the knowledge about the nuclear weapons program limited to as few people as possible. The security arrangements were specific to particular organizations and facilities and military officers assigned as heads of these security set ups were answerable to the respective heads of organizations such as the PAEC and the KRL and had no reporting channel with the GHQ. They had limited number of personnel at their disposal most of whom were retired soldiers. There was a flaw in the system as the officers selected for these assignments were usually on the verge of their retirement and therefore were prone to temptation to seek favors of the respective heads of the strategic organizations for their post-retirement rehabilitation. Most of these officers were re-employed by their respective organizations and therefore owed their loyalty to their pay masters.

This unmitigated loyalty to individuals and considerations of personal well being led to lapses in security and consequently to their failure to report any irregularities to concerned people in the general headquarters. There was no independent audit of accounts, materials or equipment and the high-powered oversight committee established during General Zia-ul-Haq's presidency was meant to facilitate provision of funds and other assistance to KRL rather than scrutinizing its performance. The customs officials were also prohibited from checking the contents of consignments destined to or going out of strategic organizations. These glaring loopholes in the system and blind faith and trust in individuals later caused national embarrassment to Pakistan, in the form of disclosures of the activities of an international illicit proliferation network involving some prominent Pakistani scientists.

Post – 1998 Reorganization of Security

In the aftermath of the nuclear tests in May 1998 Pakistan was faced with the urgent need to bring its nuclear assets under an institutionalized command and control system not only to establish its credibility as a responsible nuclear state but also for reasons of safety, security, and accountability. The National Command Authority (NCA) was formally established in February 2000, with the Strategic Plans Division (SPD) as its permanent secretariat. Amongst its constituents a position of Advisor Security NCA held by a serving army brigadier was also created. He had a few dozen people mostly comprising a mix of serving and retired military personnel at his disposal with the task of keeping an eye on the activities within the strategic organizations and reporting directly to Director General of the SPD. Even this modest effort was met

with resistance by some of the strategic organizations long used to working autonomously without any independent oversight. However, as the enormity of the task became evident a need was felt for expanding the security apparatus.

The process of expansion might have taken a more deliberate and gradual path under normal circumstances. However, the events of 9/11 followed by US led invasion of neighboring Afghanistan with its serious repercussions for Pakistan's external as well as internal security served to hasten the process. The growth of the security organization was further accelerated after the revelations of the AQ Khan's network. The force numbering thousands of personnel now re-designated as Security Division of NCA was headed by a two star general. More importantly, there was a conceptual transformation with regard to nuclear security and there was recognition of the fact that it was a specialized and demanding job which required a dedicated force especially recruited, trained and equipped to perform the task. The refurbishing and reorganization of the security force was also helped by cooperation with the IAEA and bilateral exchanges with the US especially in personnel reliability, material protection, control, and accounting (MPC&A), export and border controls. Meanwhile the Pakistan Nuclear Regulatory Authority (PNRA) had designed and started implementation of a comprehensive National Nuclear Security Action Plan (NSAP). It also brought all radiation sources in the country under effective regulatory control.

The exponential increase in the size of the nuclear security force required dedicated training facilities. A specialized training academy was, therefore, established in the outskirts of Islamabad

with the necessary wherewithal to train the newly inducted recruits in dealing with security of nuclear installations and to deal with emergency situations. This state of the art training facility was inaugurated by General Khalid Shamim Wynne, then Chairman Joint Chiefs of Staff Committee (CJCSC) on April 13, 2012. Speaking on the occasion, the CJCSC stated that, "highest standards of safety and security in the nuclear field have always been and shall remain the hallmark of Pakistan's strategic program." While expressing his satisfaction on the establishment of the SPD Training Academy he called it, "a very significant milestone in Pakistan's continued efforts towards strengthening nuclear safety and security." Adding that, "the training facility has only recently been offered for training to the international community under IAEA auspices, by the Prime Minister of Pakistan at the Nuclear Security Summit at Seoul."[9] The academy spread over a vast area provides training on the pattern of special-forces training to the officers and men of the security force. It also houses a mock nuclear facility, which has been built by Pakistan Nuclear Regulatory Authority (PNRA) with assistance from the IAEA. The academy has been turned into a Centre of Excellence that will provide realistic and high quality training environment for trainees from Pakistan as well as foreign countries.[10]

Besides creating a specially trained and equipped force, the security division has also established an 'Emergency Response Centre', at its headquarters in Rawalpindi, with an elite rapid reaction force capable of arriving at the scene of any untoward incident at any nuclear facility anywhere in the country, within a short time. It regularly conducts war games and field exercises to identify shortcomings in the system and to further hone the skills

of its forces.[11] Moreover, the security division has also installed radiation detection portal monitors at critical entry and exit points in the country to detect and prevent any illicit trafficking of nuclear and radiological materials.[12] In addition to these institutional and administrative measures, the importance of inculcating a 'security culture' amongst the various constituents of the NCA and the strategic organizations was also recognized. This was a very demanding task, given the general lack of security consciousness in Pakistan. However, after a decade's effort the security culture can be increasingly discerned in the NCA Secretariat, Security Division and various strategic organizations.[13]

The Reality of the Insider Threat

Skeptics in the international community as well as in Pakistan have voiced concerns over the presence of Islamists or Islamist sympathizers within the nuclear establishment and have expressed doubts about the effectiveness of the PRP. They usually argue that there is no information so far, at least in the public domain, to suggest that the PRP has been able to catch some offenders. On their part the Pakistani officials point towards a general tendency in the West to equate religiosity with extremism and a readiness to label any bearded person as an extremist. They concede that there is significant number of bearded scientists, engineers and even the security forces personnel but this is indicative of religiosity and conservatism, rather than religious fanaticism. They also state that as per existing policy cases of people found to be contravening the PRP regulations are not publicized. However, the offenders are removed from sensitive positions in case of any violation of rules. A very senior official responsible for security explained that

the monitoring system works in several stages and most cases are detected and corrective actions are taken pre-emptively before any misconduct could have taken place.[14]

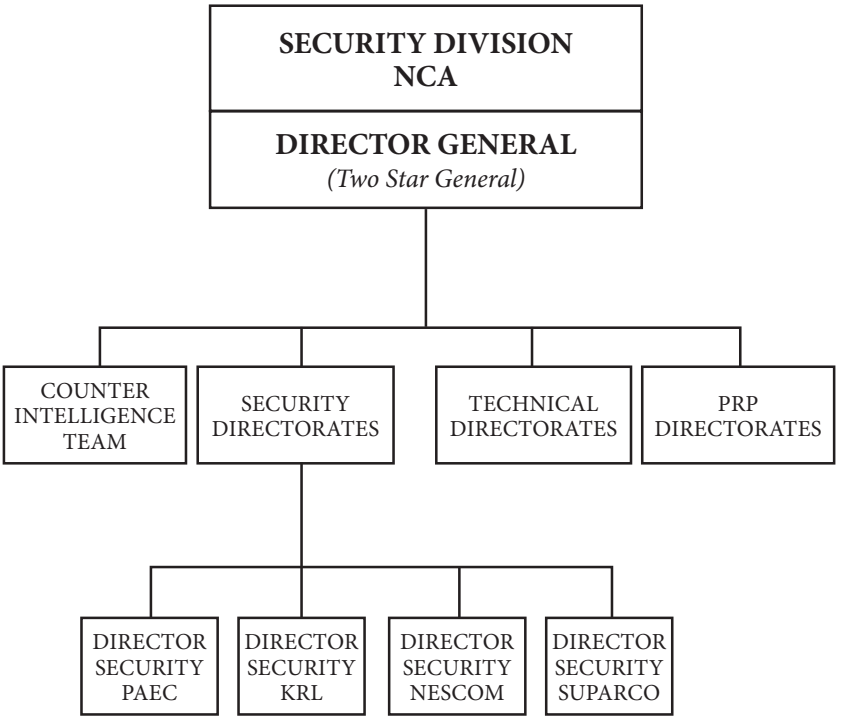
However, the small but highly vocal anti-nuclear lobby in Pakistan remains skeptical of the security system put in place by the Pakistani government arguing that, "religious conservatism gripping the applicant pool [for jobs in the nuclear establishment] makes it too difficult to discern potentially dangerous zealots."[15] In reality, all potential candidates undergo extensive background checks and their antecedents are independently verified by as many as four different intelligence agencies before they are accepted for induction. These agencies include the security division of NCA, Inter-Services Intelligence (ISI), Military Intelligence and the Intelligence Bureau and the whole screening process usually takes from 6-12 months.[16] The new employees also have to undergo psychological and medical tests which are repeated every two years besides a system of random surprise checks, as well as a 'peer reporting' system.[17]

A Pakistani academic, however, insists that, "Pakistan's 'urban Taliban', rather than illiterate tribal fighters, pose a nuclear risk. There are indeed more than a few scientists and engineers in the nuclear establishment with extreme religious views."[18] The officials, however, maintain that the existing security system has been designed to deal with any such individuals. A former senior security official in an unusually candid exchange with a Wall Street Journal correspondent on the working of the PRP program stated that one of the employees found to be distributing handouts of a religious party to his co-workers and trying to

convince them to attend a religious gathering at a local mosque was promptly removed from his job. The official elaborated that, "We don't mind people being religious, but we don't want people with extreme thoughts."[19] This example is not only illustrative of lack of tolerance for radical ideologies and practices but the ability of the system to detect and take action in case of any infringement of the laid down rules and regulations.

There have also been speculations by some journalists such as Seymour Hersh about plans and arrangements wherein the US forces would move to take control of Pakistani nuclear assets in case of any untoward incident. Reacting to one such insinuation by Hersh, General Tariq Majid, then Chairman Joint Chiefs of Staff Committee, told Pakistani media persons that, "There is absolutely no question of sharing or allowing any foreign individual, entity or state any access to sensitive information about our nuclear assets. Our engagement with other countries…to learn more about international best practices for security of such assets is based on two clearly spelt out red lines – non-intrusiveness and our right to pick and choose."[20] A prominent American South Asia expert, Michael Krepon, also dismissed Hersh's claims as headline grabbing statements.

The Organization, Role and Functions of the Security Division



As stated in the preceding paragraphs, the security division of NCA is headed by a serving two star general officer who currently has around 28,000 security force personnel under his command.[21] Each of the major entities like the PAEC, KRL, NESCOM and SUPARCO has a serving army brigadier designated as Director Security. These directors have dedicated manpower under their command and are responsible for ensuring security in their respective organizations. Unlike in the past wherein they used to report to the heads of the respective organizations they now report directly to DG Security NCA thereby ensuring independent

oversight.[22] Besides the security directorates, the security division has an additional layer of security that is provided by the counter intelligence teams spread all over the country. These teams are tasked to closely monitor the external threats including espionage and also keep an eye on threats of internal subversion. The counter intelligence teams constitute the eyes and ears of the DG Security. The technical directorate is designed to make use of all available technological means for augmenting security at nuclear facilities and to help in the early detection of threats.

The Personnel Reliability Program (PRP) Directorate has an important role in the detection and prevention of insider threat.[23] It oversees the implementation of the PRP program for personnel working in the sensitive areas of the program. The PRP program covers approximately 150,000 people in the strategic organizations, strategic forces and the SPD itself. Personnel covered by the PRP program have to go through stringent psychological, medical, social and intellectual examination at the time of recruitment and remain subject to a system of oversight as long as they serve in any sensitive part of the program.[24] The PRP directorate arranges preliminary as well as subsequent psychological, medical and character appraisals that also include surprise checks. Disciplinary action is initiated against any employee found to be in violation of the PRP regulations. As a result the offender could lose his certification, be transferred to a non-sensitive duty or dismissed from his job. As per the policy in vogue the details regarding the nature and number of cases and the actions taken are kept confidential and are not available in the public domain. However, senior officials claim that some cases of misconduct have been detected at very early stages in most cases and have been dealt with appropriately.[25]

Pakistan's Role in the Global Nuclear Security Efforts

Pakistan was part of a select group of countries that were invited by President Obama for the first nuclear security summit at Washington, DC in April 2010. It also participated in the subsequent security summits at Seoul 2012, Hague 2014 and the final summit at Washington, DC in 2016. These summits were aimed at sensitizing the top political leadership to the critical importance of maintaining highest possible standards of nuclear security. The importance of the implementation of International Convention on Suppression of Acts of Nuclear Terrorism (ICSANT) and the Convention on the Physical Protection of Nuclear Materials (CPPNM) and its additional protocol of 2005 was emphasized during the summits. As a result the required number of ratifications for entry into force of the CPPNM was achieved on the eve of the Washington summit in 2016. The summits also highlighted the significance of UNSCR-1540 and Global Initiative to Combat Nuclear Terrorism (GICNT). Pakistan has ratified the CPPNM's Amended Protocol and is in full compliance with the obligations of UNSCR-1540 besides actively participating in GICNT.[26]

At the Seoul nuclear security summit Pakistan pledged to set up a nuclear security training center and signed the Joint Statement on Nuclear Security Training and Support Centers.[27] The center referred to earlier as the SPD Training Academy, currently called as Pakistan's Centre of Excellence for Nuclear Security (PCENS), has already become a regional and international facility for nuclear security training and ran a course under the IAEA auspices on radiological security in which trainees from eight regional countries participated.[28] Pakistan has already fulfilled its commitment to deploy radiation detection portal monitors at

key entry and exit points, to check illicit trafficking of radiological materials. These portal monitors have been deployed by the Security Division as well as the PNRA.[29]

Pakistan has put in place institutional, administrative and legislative measures to strengthen its export controls regime and to secure the radiological sources. These measures include revision and updating of export control lists to ensure their conformity with latest NSG, MTCR and Australia Group lists, production of mobile laboratories to help the law enforcement agencies and local administration in dealing with any radiological emergency and up-gradation of security at nuclear medical centers around the country. These activities have been undertaken within the ambit of National Nuclear Security Action Plan (NSAP) initiated in 2006.[30] It is worth mentioning here that:-

> Pakistan has taken a number of actions related to nuclear security and safety beyond those it pledged at the summits. It has intensified collaboration with the IAEA by joining 'collaborating centers', which are designed to standardize technology, disseminate information, and facilitate research and learning on a range of issues related to IAEA activities, including nuclear safety and security. It is also participating in the development of the IAEA Nuclear Safety Action Plan.[31]

Pakistan has also enhanced the safety of its civilian nuclear facilities. Chairman of Pakistan Atomic Energy Commission (PAEC) informed the IAEA's General Conference at Vienna in September 2012 that, "Pakistan had been actively engaged in absorbing lessons from the March 2011 accident at the Fukushima nuclear reactor complex in Japan. The PAEC has identified a comprehensive set of safety retrofits that are in various stages of

implementation."[32]

Pakistan's efforts to improve nuclear safety and security are now being recognized by prominent international nuclear security experts and prestigious organizations such as the Nuclear Threat Initiative (NTI) which determined in its Nuclear Materials Security Index released in January 2014 that, "amongst nuclear-armed states Pakistan is most improved through a series of steps to update nuclear security regulations and to implement best practices, though it ranks 22nd overall."[33] Pakistan improved its position by three points since the publication of the 2012 index. It has also scored well in most areas in the latest version of the NTI index published in early 2016. During a visit to Pakistan's Centre of Excellence for Nuclear Security in March 2014 the IAEA Director General Yukiya Amano commended Pakistan's record of safe and secure running of its nuclear power plants and promised further IAEA assistance in this regard.[34]

CONCLUSION

A review of the recent writings on nuclear safety and security in Pakistan indicates that most of the concerns being expressed with regard to safety and security of its nuclear assets arise due to the generally unsatisfactory and chaotic internal security environment over the past decade. It is apparent that most experts see a nexus between 'Political Instability and Nuclear Security' and find it difficult to concede that the nuclear establishment is an island of stability and security in the midst of a generally messy domestic security landscape. It is also evident that Pakistan has not made adequate efforts to disseminate the information about

many world class systems it has instituted to strengthen nuclear safety and security. Pakistan could in fact become a role model for others to emulate.

Though Pakistan is seen as a politically unstable country with weak institutions, its valuable assets such as a seasoned civilian bureaucracy, a proactive judiciary, an independent media, a vibrant civil society and a highly professional military are generally overlooked. This ignorance or deliberate oversight then leads to alarmist and unrealistic forecasts of the imminent collapse of the country or its takeover by extremist elements such as the Taliban. These concerns about a possible takeover of power in Islamabad by religious extremists or Taliban are, however, divorced from reality. First, a forcible takeover of government by the extremists can only happen in case there is a total breakdown of the state structures and complete melt down of its military, which is highly unlikely. Second, extremists' assumption of power through ballot is also far-fetched given the historical record of Pakistani elections, wherein, even the relatively moderate mainstream religious political parties have not been able to win more than 5-7 per cent of the votes in the previous national elections. Statements such as the one by former IAEA Director General Mohammed Al-Baradei, wherein he had expressed fears of a radical elements taking the reins of power in Pakistan and thus gaining control of nuclear weapons are, therefore, are unrealistic at best.[35]

During the course of evolution of Pakistan's nuclear program, the country has experienced several serious crises that included dismissal of the Z. A. Bhutto government by General Zia-ul-Haq

in July 1977. Zia's death in an air crash in August 1988, several short lived political governments during the 1990s and General Musharraf's coup in October 1999. However, there was smooth transfer of power in all these cases and there was no adverse impact on nuclear custodial controls. Since the departure of General Musharraf's government there was an uneventful transition to civilian rule in 2008 and there was a transfer of power to the next elected government in 2013, without any disruption of nuclear command and control and safety and security systems.

In the past decade and a half Pakistan has put in the greatest effort in terms of human as well as financial resources to strengthen the safety and security of its nuclear weapons, materials and installations giving due importance to the threat posed to its nuclear assets by non-state actors operating within the country as well as the traditional sources of threat from extraneous sources. There is, however, still a room for improvement as far as the sharing of information about its achievements in this particular area.

Pakistan is also known to keep its weapons and delivery systems in de-mated form which essentially means that warheads and delivery vehicles are stored separately though some analysts have speculated that even the warheads are also kept in disassembled form.[36] However, senior officials in Pakistani nuclear establishment do not agree with this characterization and made it clear in their comments to the author that they have only talked of geographical separation between warheads and delivery systems.[37] The current arrangement adds to the safety by eliminating the possibility of an accidental, unauthorized or mistaken nuclear detonation.

As far as the safety and security of civilian nuclear installations such as nuclear power plants and research reactors is concerned, Pakistan has an unblemished record stretched over 4-5 decades.[38] Many of the concerns voiced by the media about the possibility of nuclear weapons falling in the hands of extremist elements or the possibility of an attack on Pakistani nuclear sites by the Pakistani Taliban fall in the domain of physical security rather than safety. Since these two terms are often used interchangeably and have overlapping interpretations such confusion is bound to prevail, but what matters is the fact that the policy makers have a clear perception of the nature and magnitude of the threats and have an unambiguous vision of how to deal with these.

Notes

[1]Fact Sheet: The Nuclear Security Summits: Securing the World from Nuclear Terrorism – Progress since Prague. https://www.whitehouse.gov/the-press-office/2016/03/29/fact-sheet-nuclear-security-summits-securing-world-nuclear-terrorism

[2]Three Mile Island Accident. - World Nuclear Associationwww.world-nuclear.org/information-library/safety.../three-mile-island-accident.aspx

[3]J.J. Bevelacqua, 'The Three Mile Island, Chernobyl, and Fukushima Daiichi Accidents... *nuclearsafety.info/international-nuclear-safety-journal/index.php/INSJ/article/.../114*

[4]Fukushima Accident, World Nuclear Association; http://www.world-nuclear.org/info/safety-and-security/safety-of-plants/fukushima-accident/

[5]Joseph G. Marone and Edward J. Woodhouse, *Averting Catastrophe: Strategies for Regulating Risky Technologies*, Berkeley, University of California Press, 1986, quoted in Sagan, op. cit., p. 14. Also see Todd R. La Porte, letter to Scott Sagan, September 29, 1991, quoted in Sagan, op. cit., p. 15, and Aaron Wildavsky, *Searching for Safety*, New Brunswick, N.J., Transaction Books, 1988, quoted in Sagan, op. cit., p. 16.

[6]Charles Perrow, *Normal Accidents: Living with High-Risk Technologies,*'New York, Basic Books, 1984; quoted in Scott D. Sagan, *The Limits of Safety – Organizations, Accidents and Nuclear Weapons*, New Jersey, Princeton University Press, 1993, p. 31.

[7]IAEA Safety Glossary and terms – Nuclear Safety and Security, http://www-ns.iaea.org/standards/concepts-terms.asp

[8]IAEA Safety Glossary and terms – Nuclear Safety and Security, http://www-ns.iaea.org/standards/concepts-terms.asp

[9]Inter Services Public Relations Press Release, No PR84/2012-ISPR, Rawalpindi, dated April 13, 2012.

[10]Author's visit to the SPD Academy and briefing by a senior official on 08 August 2012. The IAEA has announced to run its regional course on 'Radiation Security' for the year 2014 at the SPD Academy.

[11]Author's interview with DG Security, NCA at Rawalpindi on 07 August 2012.

[12]Ibid.

[13]During visits to some of these institutions by the author in July-August 2012 a discernible improvement in security culture and practices was seen in the form of walk through gates, electronic code controlled doors, electronic ID badges, and thorough checking/identification of visitors.

[14]Author's interview with DG Security, NCA on 07 August 2012 at Rawalpindi.

[15]Ibid.

[16]Interview with DG Security, NCA at the Security Division at Rawalpindi on 07 August 2012.

[17]Ibid. Also see Bruno Tertrais, 'Pakistan's nuclear program: a net assessment', Recherches and Documents No. 4/2012, Fondation pour la Recherche Strategique, Paris, https://www.frstrategie.org/

[18]Clary, op. cit. p. 22.

[19]Peter Wonacott, op. cit.

[20]Ibid.

[21]Author's interview with DG Security, NCA at Rawalpindi on 07 August 2012.

[22]Ibid., and author's personal knowledge of the system.

[23]The PRP Directorate was established in 2004 after the briefings and workshops

attended by relevant SPD officials in the US in 2003 and 2004.Author's interview with DG Security, NCA at Rawalpindi on 06 August 2012.

[24]Based on information received from a DG ACDA through e mail on 19 September 2014.

[25]Author's interview with DG Security, NCA on 07 August 2012 at Rawalpindi.

[26]Nuclear Security Summits, US Department of State, http://www.state.gov/t/isn/nuclearsecuritysummit/

[27]Michelle Canne, "2010 Nuclear Security Summit National Commitment Implementation," U.S.-Korea Institute at SAIS, March 2012, http://uskoreainstitute.org/wp-content/uploads/2012/03/USKI_NSS2012_Cann.pdf

[28]Inter-services Public Relations, Rawalpindi, Press Release No. PR8/2015 of January 6, 2015. file:///C:/Users/R.A3/Desktop/Inter%20Services%20Public%20Relations.html

[29]Ibid., Naeem Salik and Kenneth N. Luongo, 'Challenges for Pakistan's Nuclear Security,' *Arms Control Today*, March 2013.

[30]Naeem Salik and Kenneth N. Luongo, op. cit., p. 17-19.

[31]Ibid., p. 18.

[32]Ibid., p. 17.

[33]NTI Nuclear Security Index, Second Edition, available at http://www.nti.org/analysis/reports/2014-nti-nuclear-materials-security-index-report/

[34]'DG IAEA Visits Nuclear Centre of Excellence', *The News International*, Islamabad, March 13, 2014.

[35]"ElBaradei to Al-Hayat," *Dar Al Hayat,* English Edition online, January 10, 2008, http://english.daralhayat.com/Spec/01-2008/Article-20080110-639032eb-c0a8-10ed-01ae-81ab2ea588db/story.html

[36]Paul Kerr and Mary Beth Nikitin, op. cit.

[37]Interviews with a former Chairman Joint Chiefs of Staff and former DG SPD on 28 July and 07August 2012 respectively.

[38]Zahid Malik, 'Gilani charms Obama Brings US nuclear energy close to Pakistan,' *Pakistan Observer,* April 19, 2010

CHAPTER: 6
PAKISTAN AND THE NON-PROLIFERATION REGIME

Sannia Abdullah

The non-proliferation regime has been regarded with great skepticism by non-Western states because the regime has viewed the threats posed by weapons of mass destruction (WMDs) through the security prism of the United States (U.S.) and its allies. In short, global nonproliferation goals remain inseparable from the political interests of the U.S. For a global regime, the scope needs to be broader and more holistic in its framework to lead to acceptance of the nonproliferation norms that address the security concerns of antagonistic states at the regional level. The transition of power, prestige factors, technological determinism, and domestic politics and security considerations remain key motivations for pursuing nuclear ambitions. So far, the biggest challenge to the nonproliferation objectives has been asymmetry in its core principle of universality because the regime aims to freeze access in favor of "legitimate" nuclear weapon states (P-5

member states) that deny access to technology for nuclear have-nots. In this regard, the de facto nuclear weapon states (those nuclear weapon states outside the nonproliferation regime) consider the regime as inherently biased and meant to serve the strategic interests of Western industrialized states.

With the passage of time, the nonproliferation regime has undergone changes in response to evolving threats and a changing security landscape. After the Cold War, the U.S. anti-proliferation policy shifted from nonproliferation to counter-proliferation efforts. The counter-proliferation policy involves military actions to preemptively or preventively target the weapons of mass destruction infrastructure of the states perceived to be hostile to the US interests. Nonproliferation is distinct from counter-proliferation and is "a combination of domestic laws, international laws, technical arrangements, and bilateral agreements — all held together by skillful diplomacy and a little smoke and mirrors."[1] Nonetheless, counter-proliferation is now one of the key pillars of the nonproliferation policy. The nonproliferation regime primarily revolves around the Non-Proliferation Treaty (NPT), which is fraught with contradictions in its clauses, providing states with the loophole to cheat on their obligations.

Therefore, the problems the nuclear nonproliferation is confronted with are related not only to the statutes of the nonproliferation treaty (NPT), its enforcement mechanism or lack thereof and the verification tools to verify peaceful uses of nuclear energy, but also with a technology that is inherently susceptible to dual use. The nuclear fuel cycle, the delivery systems (aircraft/missiles and related electronics, computer hardware and software, and

engineering) cannot be separated for civilian and military purposes. Therefore, the regime is caught in the catch-22 dilemma of upholding the mission to support peaceful uses of nuclear energy, which is a sovereign right of any state, while seeking to prevent the proliferation of weapons of mass destruction (WMDs).

For India and Pakistan, the nonproliferation regime destabilizes the balance of power within the region. India considered the regime discriminatory with its cut-off date designed to allow China entry into the nuclear club while denying the same to India. For Pakistan, the regime seemed like nuclear apartheid meant to serve the interests of bigger states at the cost of ones. Its effort to deny legitimate access to nuclear technology to smaller states without addressing their genuine security concerns has been regarded as unfair. Pakistan considers itself as having been allowed fewer privileges in comparison to India and Israel, and this concern is deeply rooted in the minds of decision makers in Islamabad. The strategic inclination of the U.S. towards India has compounded Pakistan's security concerns vis-à-vis India. Therefore, Pakistan is losing faith in the commitment of the U.S. nonproliferation policies as described in the following summation:

> The prevailing wisdom of U.S. non-proliferation policymakers over the years has been to manage is human, to prevent is divine. Our policies toward India and Israel are clearly management oriented: we did not and still do not directly confront their nuclear weapons programs…But Pakistan is different. We want to prevent Pakistan from getting the bomb. In this sense, U.S. policy is similar to what it was toward South Korea and Taiwan in the mid-70s when both shut down dedicated nuclear weapons programs at U.S. insistence.[2]

Pakistan's nonproliferation policies have remained dynamic and reactive to the technological developments and the evolving security outlook of India.

This chapter focuses on two key aspects. First, it highlights Pakistan's policy perspective on the nonproliferation regime (as a de facto nuclear weapon state) and how it has evolved over the years. Second, it examines Pakistan's policy in the existing nonproliferation milieu.

The Nonproliferation Regime and Evolving Security Threats

The international security environment is becoming more challenging, particularly in the wake of the threat posed non-state actors constant quest to possess WMDs. It has exposed more gaps in the framework of the regime, including the counter-proliferation efforts that were too limited and narrow to address the challenge of emerging security threats. After the 9/11 terrorist attacks, global nonproliferation norms were revised. The United Nations Security Council (UNSC) resolution 1540 has imposed the obligation on all states to take requisite legislative, administrative and enforcement measures to prevent the possession of WMDs or related materials by terrorist groups such as Al-Qaeda. In 2003 and 2004, the revelation of the A.Q. Khan's proliferation network further aggravated the concerns regarding possible beneficiaries of the nuclear black market. The resolution required new legislation to be implemented at the national level to strengthen export control measures, gear efforts to prohibit proliferation, and enhance safety and security mechanisms to control illicit trafficking.

The A.Q. Khan network revealed security lapses not only on the part of the intelligence agencies around the world, but also within the nonproliferation regime. Some analysts contend that it has "caused enormous damage to efforts aimed at stopping the spread of nuclear weapons, to U.S. national security, and to international peace and stability."[3] The greatest damage to the Pakistani state was when the network was exposed and "Pakistan came under intense pressure to deal with Khan and his associates."[4] According to the then-President of Pakistan, General Musharraf, it was the "most embarrassing moment"[5] faced by the nation. Despite Pakistan's efforts and commitments to support nonproliferation goals, the international community is not willing to trust it. According to Mark Fitzpatrick, "This skepticism continues to haunt Pakistan's international reputation and to prevent it from receiving the kind of nuclear cooperation exemption from Nuclear Suppliers Group (NSG) guidelines accorded to India. Other nations are not convinced that proliferation from Pakistan will not happen again."[6]

To overcome such concerns, Pakistan has implemented elaborate security measures to demonstrate its resolve and commitment for the pursuit of nonproliferation objectives as described below:

> Embarrassment over the Khan case prompted a reform of Pakistan's export-control legislation and a series of accountability and oversight measures in the nuclear command and control infrastructure. When the UNSC in 2004 adopted a resolution 1540…Pakistan dutifully reported the national measures it has taken to comply. A comprehensive export-control law that was passed in 2004 and later updated includes end-use and end-user certification and penalties for violators.[7]

Pakistan's Nonproliferation Policy Perspective

Like all other countries around the world, Pakistan was adversely affected by the 9/11 attacks. However, Pakistan's strategic partnership with the U.S. revived in several domains, including efforts to denounce nuclear proliferation. Pakistan has always supported the cause of nonproliferation and tried to uphold the principles to bring stability in the region. Driven by security concerns,[8] Pakistan's nonproliferation policy is region-centric. Pakistan's policy trends can be divided into three eras:

- From 1954 to 1974 – Policy of Nuclear Abstention. Pakistan, under the Atoms for Peace program, started its nuclear journey but believed in nuclear disarmament and focused on peaceful uses of nuclear energy.

- From 1974 to 1998 – National Interests vs. Nonproliferation Regime. The 1971 dismemberment of Pakistan, Zulfikar Ali Bhutto's election to the premiership, and India's Peaceful Nuclear Explosion (PNE) in 1974 invigorated Pakistan's nuclear ambitions to seek nuclear weapons for its security. Pakistan had by then discovered that no global regime could protect its sovereignty and territorial integrity. Therefore, Pakistan's leadership was determined to develop the bomb and was ready to face the political, economic, diplomatic, and military costs.

- From 1998 onwards – The Recognition Factor and Nonproliferation Norms. The gulf between the regime and Pakistan's security concerns further widened. After the 1998 nuclear tests and having brought its national legislation in

conformity with the norms, Pakistan expected to be recognized in the global nuclear mainstream but felt discriminated against.

a) Policy of Nuclear Abstention 1954-1974

Pakistan's nuclear journey began in 1954 under the auspices of President Eisenhower's Atoms for Peace program, because of which the government of Pakistan announced a twelve-member committee to prepare plans for promoting peaceful uses of atomic energy in Pakistan. In the same year, Pakistan went into the Mutual Defense Agreement with the US under which many Pakistani military officers trained in US military schools.[9] Because of its geographical proximity with the Soviet Union, Pakistan was of politico-strategic interest to the US in the Cold War. This strategic partnership between Pakistan and the US became the bedrock of bilateral ties, including close military-to-military cooperation between the two countries. In the 1960s, Pakistan was the "most-allied ally" of the US, and for President Ayub Khan, preserving Pakistan's bilateral relations with the US was the priority.[10] Perhaps, this thinking prevailed because President Ayub Khan who "was skeptical of nuclear weapons acquisition and had faith in the U.S. security guarantees, overruled the urgings of Bhutto's nuclear lobby."[11]

b) National Interests vs. Nonproliferation Regime 1974-1998

During this time, Pakistan tried through diplomatic maneuvers to restrain India's pursuit of nuclear weapons. Pakistan knew that if India acquired the bomb, it would be compelled to do likewise.[12] Eventually, Pakistan's efforts failed to achieve the objective of a nuclear weapons free South Asia, India's so called peaceful

nuclear explosion in May 1974 effectively ended this effort. From that point onwards Pakistan arduously pursued its nuclear goals despite a dearth of resources and technology. However, Pakistan still had high hopes from the nonproliferation regime and the world at large to keep India from acquiring the bomb. Therefore, in 1974, Pakistan proposed the establishment of a South Asian Nuclear Weapon Free Zone through a resolution in the UNGA.[13] Though the resolution was passed by a majority of UN member states India's opposition[14] brought South Asia into the era of nuclear latency.

Successive US administrations were not oblivious to the nuclear efforts of both countries towards the acquisition of reprocessing and enrichment capabilities. However, U.S. policy makers assumed that given the limited resources and a limited technological base, it would be a slow process. It appeared that perhaps the U.S. planned to freeze Pakistan's nuclear program short of acquisition and testing a nuclear device, which could be termed as a "bomb in the closet" approach. In 1976 and1977, the U.S. passed the Symington and Glenn amendments respectively to the Foreign Assistance Act to prohibit economic and military aid to Pakistan.[15] While "President Carter had attempted to use the economic sanctions stick on both India and Pakistan. President Reagan had attempted to use the economic/ military aid as a carrot for Pakistan. Neither approaches worked."[16] The U.S. policies were not stringent because Pakistan was needed to bring an end to the Cold War. In this regard, "Afghanistan provides a striking case history of what often happens to nonproliferation policy when it comes up against a competing foreign-policy interest. It loses badly."[17]

While moving towards acquiring nuclear weapons for deterrent purposes, Pakistan at the outset signed the Biological and Toxin Weapons Convention (BTWC) in 1972 and ratified it in 1974. It moved from policy to practice by favoring the convention and urged participation from other countries as part of Non-aligned Movement (NAM) to engage in peaceful exchange of biological and toxin materials for further research. In the 2011 BTWC Review Conference, Pakistan proposed draft legislation that prohibited "designing, development, manufacturing, stockpiling, transport, import, export, sale, acquisition and possession of biological agents and toxins including their means of delivery…."[18] Legal and administrative steps were taken in its national regulatory framework to strengthen its biosecurity and biosafety regulations under the Biosafety rules[19] (2005) (including the Drug Act 1976, Plant Quarantine Act 1976, Animal Quarantine Act 1979, Anti-Terrorism Act 1997, and Export Control Act 2004 in addition to the provisions of the Pakistan Penal Code).[20] In 2004, Pakistan promulgated the Export Control on Goods, Technologies, Material and Equipment Related to Nuclear and Biological Weapons and their Delivery Systems Act[21] and set up the Strategic Export Controls Division under the Ministry of Foreign Affairs to regulate exports of biological, nuclear, and missile-related products. In 2011, an updated list was issued in conformity to the statutes of the Australia Group, even though Pakistan is not a member of the group.

In 1978, Pakistan proposed the Joint Renunciation of Acquisition or Manufacture of Nuclear Weapons as a bilateral measure to renounce production, manufacture, and acquisition of nuclear weapons.[22] The offer was rejected by India. From the Indian perspective, the pursuit of nuclear weapons was essential for

India's global status, and after the Sino-India war of 1962, India's prestige factor became subservient to security. Therefore, India's nonproliferation policy continued to revolve around its larger nuclear neighbor, China, and India was never willing to heed regional proposals aiming at prevention of proliferation of nuclear armaments. While cognizant of India's threat perceptions vis-à-vis China, Pakistan tried to bring transparency into the bilateral relations of India and Pakistan to ensure the peaceful uses of nuclear technology. Pakistan proposed in 1979 that both countries should open their nuclear facilities for International Atomic Energy Agency (IAEA)-administered inspections under the Mutual Inspections of Nuclear Facilities, to which India again did not agree.[23] Indian threat perceptions multiplied in the face of growing Sino-Pakistan ties.

In the early 1980s, Pakistan increased its efforts in the United Nations for a test ban. It was anticipated that India might test again during this time.[24] Therefore, in 1987, Pakistan suggested a Regional Nuclear Test Ban Agreement, an offer to prevent a nuclear arms race in South Asia, but India again turned down the proposal.[25] In 1994, Pakistan tried to secure the region from a missile race and to limit the procurement of ballistic missile capabilities through the South Asia Zero Missile Zone. No progress was achieved because it was "India which vetoed these initiatives."[26] It was noted that "Pakistan has been rebuffed by India, however, on a series of specific proposals for a South Asian nuclear weapons free zone, Simultaneous Accession to the 1968 treaty on the Nonproliferation of Nuclear Weapons (NPT) in 1979, and even bilateral nuclear nonproliferation guarantees."[27] The consistent refusal to accept any bilateral/multilateral frameworks

of nonproliferation by India strengthened Pakistan's resolve to develop its capability at the earliest possible moment.

At both the United Nations and the Conference on Disarmament (CD), Pakistan supported the broader nonproliferation goals but was not willing to support any proposal directly impinging on regional stability. Since the 1990s, Pakistan has supported the Negative Security Assurances (NSAs) and introduced annual resolutions at the UNGA. The domestic debate on the Comprehensive Test Ban Treaty (CTBT) renewed when the P-5 countries signed it on September 24, 1996.[28]

India changed its policy stance and reversed its political goal on the CTBT, which had been pursued by the Indian Prime Minister Nehru and his successors. But in the wake of the changed regional security environment, "New Delhi took issue with a complex entry-into-force (EIF) provision that would make the treaty contingent upon India's deposit of its instrument of ratification, along with no less than 43 other states that then possessed nuclear power or research reactors."[29] In 1995, the NPT was extended indefinitely, and Indian leadership presumed that the CTBT would also be used to supplement it. India's then interim BJP government was apprehensive of heated debate on the CTBT and pledged to declare India a nuclear weapon state after being elected. Thus, domestic politics, global aspirations, and security provided the Indian establishment with a rationale to establish its nuclear status, which they had always aspired. Upon experiencing the international political pressure for securing nonproliferation goals (CTBT), Indian leadership was wary of the next possible milestone (i.e. the prospective fissile materials cut off treaty).[30]

After the May 1998 nuclear tests, Pakistan announced a unilateral moratorium on nuclear testing. Pakistan considered that at an appropriate time both countries should formalize their respective unilateral moratoriums into a bilateral agreement to promote regional stability. On August 12, 2016, the Prime Minister's Adviser on Foreign Affairs, Sartaj Aziz, stated: "We have declared a unilateral moratorium on further testing. Pakistan is prepared to consider translating its unilateral moratorium into a bilateral arrangement on non-testing with India."[31] Nonetheless, India's stance on the CTBT was clear. Arundhati Ghose, the permanent representative of India to the United Nations in Geneva in 1996, had already stated in very clear terms that India's decision on CTBT was "not now, not later."[32]

While South Asian regional stability is being impacted by an ongoing strategic competition, the prospects for arms control and regional stability are growing bleak. The widening conventional asymmetry between the two countries puts Pakistan under greater strategic pressure to rely more and more on nuclear weapons for deterrence. While India is advancing in its space program, the fear of a future war in South Asia is increasing. Recognizing outer space as a likely domain of future conflicts in South Asia, Pakistan urged the commencement of Prevention of Arms Race in Outer Space (PAROS) negotiations in the CD. Apart from outer space, Pakistan is interested in holding talks on issues such as cyber security and lethal autonomous weapons systems.[33] However, India finds little incentive now to enter into any bilateral agreement with its small nuclear neighbor (Pakistan) while competing with China.

c) Pakistan and the Recognition Factor Post-1998

After the 1998 nuclearization, the proposals presented to India by Pakistan sought nuclear restraint and strategic stability in the region.[34] The first milestone was to overcome hostility and revive political engagement. In February 1999, the landmark agreement known as the *Lahore Memorandum of Understanding* was signed between political leaders of both countries. This comprehensive document provided the basis for several CBMs, arms control arrangements, and prospects of conflict resolution between the two countries. Unfortunately, the outbreak of Kargil war (1999) eroded the spirit of the agreement and proved detrimental to building mutual trust.

Pakistan also offered the Strategic Restraint Regime (SRR) to address strategic stability through conventional and nuclear restraints and to resolve the core issue of conflict between the two countries (i.e., Kashmir). The SRR was to overcome Pakistan's fundamental problem of conventional threat from India. Islamabad believed that without tangible security assurances on maintaining conventional deterrence in South Asia, Pakistan would not be in a position to enter into strategic CBMs with India. The SRR laid out a wide array of initiatives, including creation of a Low Force Zone close to border areas, mutual and balanced conventional force reduction by considering the existing force ratios, identifying offensive force postures and locations, and mutual missile restraint in conjunction with conflict resolution approaches.[35] In furtherance of global nonproliferation goals, the strategic stability equation between India and Pakistan needs to be balanced, without which the major treaties like CTBT and the Fissile Material Cut-Off Treaty (FMCT) will remain elusive.

Pakistan's response to the Western and the U.S. nonproliferation policies has taken a new direction. Now the biggest concern and challenge for Pakistan is its desire to be recognized as a responsible nuclear weapon state in the international community. In Pakistan's perceptions, the nonproliferation regime has been discriminatory in denying Pakistan similar privileges as bestowed upon other de facto states (including Israel and India). These concerns were aggravated after the Indo-U.S. strategic cooperation agreement was signed by the two countries. As part of the agreement in 2008, India was given a special waiver by the NSG under US pressure. In this way, the doors to nuclear commerce have now opened to India, and its nuclear status as a non-NPT state has been acknowledged. Consideration of India's membership of the NSG if materialized would further complicate Pakistan's acceptance in the global nuclear mainstream. Pakistan's objection to India's membership revolves around three principles: First, India is not a signatory to the NPT and therefore should not be considered for NSG membership. Second, India has not shown any commitment to sign the CTBT, and third, the Additional Protocol it has signed with the IAEA as required by the Indo-U.S. nuclear deal does not have much substance.[36]

On the contrary, Pakistan believes that its credentials are better than India's to be considered for such a membership. Pakistan has regulated its export control measures under the new Export Control Act 2004[37] to bring them into conformity with the international standards.[38] To deal with safety mechanisms of its civil nuclear plants and to deal with accidents resulting from radiological fallout, the Pakistan Nuclear Regulatory Authority was established in 2001.[39] Pakistan has recently ratified the Additional

Protocol to the Convention on the Physical Protection of Nuclear Materials (CPPNM) which had entered into force in March 2016, legally binding states to prevent, detect, and punish the offenses related to nuclear materials. A Ministry of Foreign Affairs press release contended, "The ratification of the 2005 Amendment to the CPPNM is a reaffirmation of Pakistan's commitment to the objective of nuclear security."[40] Pakistan's ambassador at the United Nations, Maleeha Lodhi, said, "Pakistan had implemented a comprehensive export control regime, participated in the *Nuclear Security Summit* process, ratified the 2005 amendment to the Convention on Physical Protection of Nuclear Materials, declared unilateral moratorium on further nuclear testing and reiterated its willingness to translate it into a bilateral arrangement on non-testing with India, all of which established its eligibility to become an NSG member."[41]

In the views of some other experts, Pakistan's application stands on the solid ground of "technical experience, capability, and well-established commitment to nuclear safety and security, as well as great potential for actual growth."[42] While some in Pakistan are arguing for its NSG credentials on merit, there are shared concerns within the strategic community debating the regional implications if India becomes a member. It is generally believed that giving membership to India and depriving Pakistan of the same would further enhance nuclear competition among the arch rivals.[43] Through diplomatic channels, Pakistan has sought cooperation from other states, including China, to oppose India's bid. "While China may not be able to persuade the NSG to admit Pakistan, it can block India because new members are admitted

with a consensus of the existing members."[44] Director General Disarmament at the Pakistani Ministry of Foreign Affairs, Kamran Akhtar, has stated that, "Pakistan believes membership in the NSG is imperative for recognition as a responsible nuclear state and access to sophisticated nuclear technology."[45]

The prospects for arms control between India and Pakistan seem to be bleak in the foreseeable future. India has always justified its capabilities vis-à-vis its two nuclear neighbors, Pakistan and China. "New Delhi sees Pakistan and China as brother enemies — potentially fraternal partners, but by circumstance and choice dangerous antagonists."[46] With this perception, India has always preferred to resolve outstanding issues between the two countries, including Kashmir, bilaterally without foreign mediation because it feels that the balance of power is tipped in its favor.[47] Moreover, after the Mumbai crisis, it rejected resumption of dialogue, claiming Pakistan's support for terrorism on Indian soil. On the contrary, Pakistan found "itself in a strategic competition with India where trajectories favored India, while the alliance did not mitigate its security concerns."[48]

Apart from the NSG, Pakistan has a divergence of opinion on other nonproliferation initiatives, including the treaty on fissile materials. Pakistan's position on the FMCT in the CD is to take into account existing stocks to prevent a growing strategic imbalance in the region. This stance requires an agreement amongst the CD members on the scope of the treaty itself which is currently deadlocked due to Pakistan's opposition to the resumption of talks unless this issue is resolved. On June 5, 2014, Pakistan's then permanent representative at CD, Ambassador Zamir Akram, said:

> We propose that this weaponized fissile material may not be touched by the treaty, and be dealt with in the future Convention on Nuclear Disarmament…[Regarding] fissile material that has not been weaponized as yet, but set aside either for new warheads or for the replacement and refurbishment of existing warheads, [including] irradiated fuel and reactor-grade separated plutonium produced from any unsafeguarded reactor – military or otherwise, [w]e propose that this non-weaponized fissile material should be brought under the verification coverage of the treaty and placed under safeguards to ensure its non-diversion for nuclear weapons manufacturing. The transfer of this material to safeguarded civil and non-proscribed military use may be permitted… A second option would be to reduce this sub-category of fissile materials to the lowest possible levels necessary for the safe maintenance of nuclear arsenals through mutual and balanced reductions on a regional or global basis. Material assigned for nuclear weapons including the fissile material released from retired warheads and those in the dismantlement queue, including such material that is already in waste disposal sites… should also be brought under safeguards in accordance with the principle of irreversibility to preclude its re-weaponization. Its transfer to safeguarded civil and non-proscribed military use would be permitted. [As for] fissile material not assigned for nuclear weapons [e.g.,] material designated for civil purposes; excess material for military purposes; and material for non-proscribed military activities like naval propulsion etc.[49]

Within academic circles, Pakistan's official position on the FMCT has been subject to debate for many reasons. Some argue that Pakistan has not successfully articulated the rationale for its veto on nonparticipation in the talks at the CD. The issue of bringing in existing stockpiles would require countries to reveal the quantity and location of their existing stocks and subject them to foreign inspections, which most countries would be unwilling to do,

including Pakistan.[50] To Pakistan, the issue of FMCT and the Indo-U.S. Civil Nuclear Deal has ramifications directly impinging on Pakistan's strategic deterrent and would freeze India's advantage in fissile materials stockpiles in perpetuity. This would undermine South Asia's strategic balance in favor of India. Furthermore, it was asserted that India's breeder reactors would be an additional source for fissile material, a concern that is met by doubts about the efficiency of the Indian breeder program by Western experts.[51] Until now, Pakistan's position on the FMCT was solely based on security concerns, but Pakistan appears to have linked the progress on FMCT with the demand for a similar civil-nuclear deal to that offered to India. The change in its stance has weakened Pakistan's argument on security concerns and reaffirmed that Pakistan's deterrence is aimed at seeking strategic equivalence vis-à-vis India.

CONCLUSION

The nonproliferation regime has not been able to satisfy either the liberal supporters or the conservative critics of arms control. Although, the liberals sitting in many capitals of the world still view the regime as a success that has barred several states from acquiring nuclear weapons as predicted by President Kennedy, who believed that "there are indications…that 10, 15, or 20 nations will have a nuclear capacity, including Red China, by the end of the Presidential office in 1964.…I think the fate not only of our own civilization, but I think the fate of world and the future of the human race is involved in preventing a nuclear war."[52] The conservatives believe that potential nuclear weapon states cannot be stopped from acquiring nuclear weapons.

It is important to understand that regional politics is always under the catalytic influence of strategic developments taking place at the international level. For India, the rationale for its nuclear ambition was achieving global status after the Sino-India war, whereas Pakistan's concern was solely based on realism driven by a security imperative. Both India and Pakistan for entirely different reasons decided not to sign the NPT. For both of them, the regime is discriminatory when it accepts the "legitimate" nuclear status as an exclusive right of the privilege few. Different export control regimes like NSG, MTCR, the Australia Group on chemical and biological weapons, and the Wassenaar Arrangement on conventional weapons and dual-use goods/technologies are seen as Western cartels that should not deny technology to the developing countries. Thus, the nonproliferation regime seen from any perspective is confronted with serious challenges.

The case of South Asia is instructive here, where the two arch rivals started off their nuclear ambitions with totally different motivations. Pakistan's nonproliferation policies shifted because of changing geopolitical circumstances. For Pakistan, the unit of analysis is regional, and the global nonproliferation norms cannot be treated in isolation without addressing strategic stability in the region. Over the years, Pakistan's perceptions of "distrust of allies, belief in unfair treatment, proud self-image, threat perceptions, and images of its adversary"[53] have reinforced its security concerns and undermined its confidence in strategic capabilities. The element of mistrust between the U.S. and Pakistan proved detrimental in developing coherent approaches over nonproliferation issues of mutual benefit. Consequently, no common ground has been established. In the midst of allegations, the security concerns

prevailed over the harnessing of cooperative approaches. For Pakistan, the concerns are deep-rooted in a history that questions the viability of the nonproliferation regime at the regional level. Thus, the nonproliferation goals remain daunting for the outlier states, including Pakistan and the breach will likely widen in the foreseeable future.

Notes

[1]Zachary S. Davis, "Overview of Power and Nuclear Weapons," in *Nuclear Power and Spread of Nuclear Weapons: Can We Have One without the Other,* eds. Paul Leventhal, Sharon Tanzer, Steven Dolley (Potomac Books Inc., 2002), chapter 11.

[2]Testimony by Paul Leventhal, "On Pakistan and U.S. Nuclear Non-Proliferation Policy," Before the House of Foreign Affairs Committee October 22, 1987, available at http://www.nci.org/t/t102287.htm

[3]David Albright and Corey Hinderstein, "Unraveling the A.Q. Khan and Future Proliferation Networks," *The Washington Quarterly*, vol. 28, no. 2 (2005), p. 111.

[4]Ibid., p. 116.

[5]Pervez Musharraf, *In the Line of Fire* (New York: Free Press, 2006) p. 292.

[6]Mark Fitzpatrick, *Overcoming Pakistan's Nuclear Dangers* (London: IISS, 2014), p. 141.

[7]Ibid., p. 145.

[8]Ibid., p. 24.

[9]Zian Mian, "Fevered with Dreams of the Future: The Coming of the Atomic Age to Pakistan," at https://www.princeton.edu/sgs/faculty-staff/zia-mian/Fevered-with-Dreams-of.pdf

[10]Feroz Hassan Khan, Nuclear Proliferation Motivations: Lessons from Pakistan, *Nonproliferation Review*, vol. 13, no. 3, 9 November 2006), p. 503.

[11]Ibid., p. 506.

[12]Ibid.

[13]Samina Ahmed, "Pakistan's Proposal for a Nuclear Weapon-Free Zone in South Asia," *Pakistan Horizon,* vol. 32, no. 4, Pakistan Foreign Policy (Fourth Quarter, 1979), pp. 92-130.

[14]Ibid.

[15]Leonard S. Spector, *The Undeclared Bomb: The Spread of Nuclear Weapons, 1987-1988* (Harper Business 1990), pp. 80-148.

[16]Raju G. C. Thomas, "Nuclear Weaponization in South Asia: Did US Non-Proliferation Policy Make Any Difference?," Presented before the NPEC/IGCC Summer Faculty Seminar on July 11-14, 2001, at http://npolicy.org/userfiles/file/Model%20Weapons%20Syllabus/Nuclear%20Weaponization%20in%20South%20Asia-Did%20US%20Non-Proliferation%20Policy%20Make%20Any%20Difference.pdf

[17]Testimony by Paul Leventhal, op cit.

[18]Statement by Ambassador Zamir Akram, Permanent Representative of Pakistan to the United Nations, at the Seventh BWC Review Conference, Permanent Mission of Pakistan to the United Nations, 6 December 2011, www.opbw.org

[19]Pakistan Biosafety Rules 2005, Notification, April 21, 2005, available at http://www.nti.org/media/pdfs/pakistan_bw_biosafety_rules_1.pdf?_=1339193223&_=1339193223

[20]Ibid.

[21]The Gazette of Pakistan, Export Control on Goods, Technologies, Material and Equipment Related to Nuclear and Biological Weapons and their Delivery Systems Act, September 24, 2004, available at http://www.nti.org/media/pdfs/Act_No._V_of_2004.pdf?_=1327700197

[22]*Pakistan's Credentials for NSG*, Ministry of Foreign Affairs, Government of Pakistan, August 2016, p. 8; see also A.H. Nayyar, "A Pakistani Perspective on Nuclear Disarmament and Non-proliferation," Friedrich Ebert Stiftung, FES Briefing Paper 9, August 2008, p. 5.

[23]*Pakistan's Credentials for NSG*, op cit., p. 9; also see Shamshad Ahmad, "The Nuclear Subcontinent: Bringing Stability to South Asia," *Foreign Affairs,* vol. 78, no. 4 (Jul. - Aug., 1999), pp. 123-125.

[24]Bhumitra Chakma, *Pakistan's Nuclear Weapons* (Oxon: Routledge, 2009) p. 92.

[25]Ibid. Also see *Pakistan's Credentials for NSG*, op cit., p. 9.

[26]K.R. Gupta, *Selected Documents on Nuclear Disarmament* (New Delhi: The Atlantic Publishers and Distributers, 2001), p. 262.

[27]Rodney Jones, "Pakistan's Nuclear Posture: Quest for Assured Nuclear Deterrence- A Conjecture," *Regional Studies*, vol. XVIII, no.2 (Spring 2000), p. 26.

[28]Michael Krepon, "Looking Back: The 1998 Indian and Pakistani Nuclear Tests," *Arms Control Today*, https://www.armscontrol.org/act/2008_05/lookingback

[29]Ibid.

[30]A. Vinod Kumar, "India and the CTBT: The debate in New Delhi," *Bulletin of the Atomic Scientists*, 4 November 2009.

[31]Zafar Jaspal, "CTBT: Cautious Decision," *Pakistan Observer*, September 1, 2016.

[32]Devirupa Mitra, "As Obama Seeks UNSC Resolution to Support CTBT, India Keeps Its Options Open," *The Wire*, August 9, 2016.

[33]*Pakistan's Credentials for NSG*, Ministry of Foreign Affairs, Government of Pakistan, August 2016, p. 10.

[34]A.H. Nayyar, "A Pakistani Perspective on Nuclear Disarmament and Non-proliferation," Friedrich Ebert Stiftung, *FES Briefing Paper 9*, August 2008, p. 5.

[35]Ibid.

[36]Ali Sarwar Naqvi, "India, Pakistan and the NSG," *The News*, August 25, 2015.

[37]For details see *Pakistan's Credentials for NSG*, Ministry of Foreign Affairs, Government of Pakistan, August 2016.

[38]Naeem Salik, "Pakistan and the Future Nonproliferation Regime," op cit., p. 24.

[39]Ibid.

[40]"Pakistan ratifies the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material," Ministry of Foreign Affairs Press Release PR. No.103/2016, March 23, 2016.

[41]"Pakistan Makes Strong Pitch for NSG Membership," *Dawn*, August 25, 2016.

[42]Sehar Kamran, "The NSG and Pakistan's Membership Bid," *The Nation*, September 12, 2016.

[43]Sultan M. Hali, "Indo-Pak Quest for NSG Membership," *Pakistan Times*, June

25, 2016.

[44]Ibid.

[45]"NSG Membership Vital for Pakistan's Recognition as Nuclear State: Kamran," Radio Pakistan, November 09, 2016 at http://www.radio.gov.pk/09-Nov-2016/nsg-membership-vital-for-pakistan-s-recognition-as-nuclear-state-kamran

[46]Kanti P Bajpai, "Conflict, Cooperation and CSBMs with Pakistan and China: A view from New Delhi" in *Mending Fences: Confidence and Security Building Measures in South Asia*, eds. Sumit Ganguly and Ted Greenwood (Westview Press, 1996), p. 16.

[47]Feroz Hassan Khan, "Prospects of Arms Control and CBMs between India and Pakistan," at http://www.npolicy.org/article_file/Prospects_of_Arms_Control_and_CBMS_Between_India_and_Pakistan-ESSAY.pdf

[48]Ibid.

[49]*Informal Discussions on Agenda Items 1 and 2 with a General Focus on the Ban of the Production of Fissile Materials for Nuclear Weapons and Other Nuclear Explosive Devices* [Statement by Ambassador Zamir Akram Permanent Representative at the Conference on Disarmament] 56 Rue de Moillebeau, 1211 Geneva, 05 June 2014, at http://fissilematerials.org/library/pk14b.pdf

[50]Michael Krepon, "Pakistan and the FMCT," *Dawn*, February 14, 2012.

[51]Michael Krepon, "Will Pakistan and India Break the Fissile Material Deadlock?" *Arms Control Wonk*, July 31, 2014.

[52]John F. Kennedy Speeches, October 13, 1960, available at https://www.jfklibrary.org/Research/Research-Aids/JFK-Speeches/3rd-Nixon-Kennedy-Debate_19601013.aspx

[53]Feroz Hassan Khan, "Nuclear Proliferation Motivations: Lessons from Pakistan," op cit., p. 503.

CHAPTER: 7

PAKISTAN AND THE IAEA

Ali Sarwar Naqvi and Saima Aman Sial

Introduction

Pakistan has a long history of cooperation with the IAEA, starting with the inception of the agency itself. Entrusted with the goal to promote the peaceful uses of nuclear energy, while ensuring the non-diversion of materials and technology for nuclear weapons production; the Agency undertakes technical assistance programs with developing states and has put in place a system of nuclear safeguards, with the aim of creating a balance between its promotional and monitoring roles.

Owing to its advanced nuclear program, Pakistan has always been considered a respectable member of the agency and a strong proponent of the peaceful nuclear applications of nuclear

technology. It plays a productive role in promoting the agency's mandate in this regard. Through its trained and skilled manpower and expertise the country has been contributing to the work of the agency while profiting greatly from the technical assistance program. Pakistan usefully and beneficially avails of the agency's cooperation in sustaining and expanding its national programs in the fields of agriculture, biotechnology, nuclear medicine, industrial applications as well as nuclear safety, security technical and regulatory infrastructure.

To realize the full potential of nuclear technology applications for the benefit of its people, Pakistan has also been utilizing nuclear energy for electricity production. In this regard, four nuclear power plants (NPPs) have already come online with more NPPs at various stages of construction and planning to realize the Energy Security Plan 2050. The plan envisages some 40,000 MWe to be produced through nuclear energy in the overall energy mix. Currently, all of Pakistan's civilian nuclear power plants are under IAEA safeguards and the country has never been reported for any non-compliance with its safeguards agreements.

This chapter is based broadly on two sections; the first is a brief history of the creation of the International Atomic Energy Agency and the second part covers various aspects of Pakistan-IAEA cooperation.

Genesis of the International Atomic Energy Agency

> To hasten the day when fear of the atom will begin to disappear from the minds of the people and the governments of the East and West, there are certain steps that can be taken now…the more important responsibility of this atomic energy agency would be to devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world.
>
> US President Eisenhower, 8th December 1953[1]

US President Eisenhower's speech in the UNGA towards the end of 1953, became the starting point for the exploration of the idea of developing a body under the purview of the United Nations entrusted "to take this weapon out of the hands of the soldiers [and] put into the hands of those who will know how to strip its military casing and adapt it to the arts of peace." The proposal is widely recognized for its "transparency … international co-operation in developing and applying nuclear technology for peaceful purposes, i.e. Atoms for Peace"[2] but also criticized for many reasons. It failed to achieve its aim as initially set out in the speech. The IAEA wasn't mandated to control the arms race that developed later and the Cold War further fueled the nuclear arms race until the eventual demise of the former Soviet Union.[3]

On 12 September 1945, a month after the wielding of the massive destructive power of the atomic weapons on Hiroshima and Nagasaki, Henry L. Stimson, the US Secretary of War, recommended to US President Truman, that the US should

propose to the USSR to "conclude a covenant to control and limit the use of the atomic bomb as an instrument of war and...To direct and encourage the development of atomic power for peaceful and humanitarian purposes..." Unfortunately, the advice fell on deaf ears and it may be suspected that the US avoided approaching the USSR, fearing possible skepticism of Stalin for such a proposal.

Later, on 15 November 1945, American, British and Canadian heads of government issued a "Three Nation Agreed Declaration on Atomic Energy" proclaiming their willingness "to proceed with the exchange of fundamental scientific literature for peaceful ends with any nation that will fully reciprocate" but on the condition that such exchange would be under effective reciprocal and enforceable safeguards which are acceptable to all nations. In December of the same year, US U.K and USSR, agreed on the creation of United Nations Atomic Energy Commission (UNAEC) "to consider problems arising from the discovery of atomic energy and related matters."[4]

Although UNAEC was established in 1946, it determined in a few years' time that its work had failed to contribute meaningfully towards promoting nuclear energy while preventing the spread of nuclear weapons. The reasons mainly related to the nature of proposals presented by the states in an environment of mutual distrust.

Negotiations

Before the establishment of the IAEA as an oversight agency, the US and USSR had been securing nuclear agreements with various

states by exporting research reactors to strengthen ties with allies. It is recorded that by 1959 US had concluded 42 nuclear cooperation agreements with various states and USSR caught up later and by 1968 had signed nuclear cooperation agreements with 24 states. These agreements mostly concluded by US before the establishment of the IAEA assumed that the role of the safeguards would later be entrusted to the prospective agency.

The US made the earliest proposal to the USSR about establishment of the IAEA on March 19, 1954, with a draft statute of the proposed agency. The proposal was however turned down by the USSR. Later on, the US informed the USSR that, it would proceed with the establishment of the agency without USSR and in May 1954 US intimated to the General Assembly its intention to establish an atomic energy agency and in this regard called for a conference on peaceful uses of nuclear energy by the UNGA.

On a separate track, not only did the US keep the UK, France and Canada informed about its discussions with USSR but it also started negotiations on the draft statutes proposed by the UK. The Eight Nations negotiating group including US, UK, Canada, France, South Africa, Belgium, Australia and Portugal began negotiations on the statutes of the agency by early 1955. By July 1955, the USSR agreed to join the negotiations marking the first thaw in the Cold War rivalry between the two great powers.

Moreover, further impetus came from the international conference planned to be organized by the UNGA on peaceful uses of atomic energy. In August 1955, the first Geneva Conference made states aware about the peaceful uses of nuclear technology and

prospects of nuclear energy, with a large participation of scientists and engineers. After the conference when US, UK, USSR, Canada, France and Czechoslovakia discussed the technical aspects regarding the safeguards, the scientists (that participated in the Geneva conference) became part of these discussions to assess the technical aspects of the safeguards to be applied by the proposed agency.

The next challenge was to establish whether the IAEA was to act as a pool bank for nuclear fuel drawn from nuclear weapon states and contribute to nuclear disarmament, or just be a 'clearing house'.[5] Finally, with the USSR, Czechoslovakia, Brazil and India joining in early 1956, this twelve nation-negotiating group discussed the statutes of the agency and in a short time span of eight weeks, i.e. from February 27 to 18 April 1956, were able to prepare the draft statute which was approved on 23 October 1956 and came into force on 29 July 1957.

IAEA: Functions and Organs

The IAEA came into being to promote safe, secure and peaceful nuclear technologies. It now has 168 member states in 8 regions, i.e., North and South America, Western Europe, Eastern Europe, Africa, Middle East and South Asia, South East Asia and the Pacific and the Far East.

The stated objective of the agency, as documented in the IAEA statute is to accelerate and enlarge the contribution of atomic energy for the peace, health and prosperity throughout the world; while ensuring that "the assistance provided by it or at its request

or under its supervision or control is not used in such a way as to further any military purpose."[6]

The agency promotes scientific and technical cooperation for peaceful uses of nuclear technology as well as nuclear power worldwide. IAEA programs are meant to encourage the development of nuclear technology for peaceful applications it ensures and implements international safeguards to prevent any possible diversion of nuclear technology and materials for military purposes and sets nuclear safety and security standards as well as their implementation.

The agency has three main pillars; Nuclear Science & Technology, Nuclear Safety & Security and Nuclear Verification (Safeguards). It is headed by a Director General and has six Deputy Director Generals who head the departments of Nuclear Energy (NE), Nuclear Safety & Security (NS), Nuclear Science & Applications (NA), Technical Cooperation (TC), Safeguards (SG) and Management (MT) respectively. The Article V and VI of the Statutes define the powers of the Board of Governors (BoG) and the General Conference (GC).

General Conference

The General Conference comprising all members of the agency meets annually in a regular session or as required in a special session as decided by the BoG. The GC has powers to elect its own President each year and adopt its own rules of procedure, by two-third majority of member states present and voting. Its functions include; election of the board members, approval of new

membership, consideration of annual report by BoG, approval of budget as recommended by the BoG and approval of amendments to the statute and appointment of the Director General. Moreover, its powers include referring a matter relating to the functions of the agency to the BoG for consideration as well as deciding on matters referred to it by the board.[7]

Board of Governors

The BoG is the policy-making organ of the Agency, which has 35 members, chosen from the eight geographical regional groups.[8] Ten members of the board are elected based on their advancement in nuclear technology and peaceful uses of nuclear energy while twenty are selected based on the principle of equitable geographic representation. The BoG takes decisions with regard to the agenda set for the board that includes technical cooperation programs, annual budget, safety and security, verification activities etc. between IAEA and its member states. The BoG is also mandated to prepare and submit an annual report to the General Conference.[9]

Pakistan belongs to the Middle East and South Asia (MESA) Group and members can be elected on the BoG seat for the region for two years each with a gap of one year. Up till now, Pakistan has remained on the board for twenty-one terms and has also served as the Chairman of the board thrice.[10]

Pakistan's Cooperation with the IAEA

Pakistan joined the IAEA as one of the pioneer members of the agency in 1957. Its nuclear program was originally envisaged for peaceful purposes and Pakistan was keen to promote the

peaceful uses of nuclear science and technology. Therefore, since the inception of IAEA, Pakistan has sustained a mutually beneficial relationship with the agency as has been evident from its selection to the IAEA Board of Governors (BoG) twenty-one times for two-year terms each.[11] Not only has Pakistan served on the IAEA Board of Governors but it also has the honor of chairing the Board thrice in 1962, 1986 & 2010. Pakistan's cooperation with the agency has been reciprocal, i.e. not only has Pakistan benefitted from the agency, the agency has also greatly benefitted from Pakistan's nuclear expertise and its human resources. As an acknowledgement of the enduring relationship, in the last couple of years, five DDGs of the IAEA (TC, NE, NA, SS & SG) have visited Pakistan, apart from the high level visit of DG IAEA Mr. Yukiya Amano in the year 2014.

Pakistan has been a beneficiary of the IAEA assistance and its government is fully committed to enhancing this collaboration with the agency in diverse fields ranging from nuclear power development to that of human health, agriculture and livestock. Under the Technical Cooperation program of the IAEA, Pakistan's Country Program Framework (CPF) 2014-19, provides for assistance in a wide range of areas including nuclear power development, nuclear safety and security, industrial applications, radioactive waste management, human health, water resources, food, agriculture, livestock and environmental protection.[12]

This multifaceted cooperation between Pakistan and the agency in various fields ranging from nuclear power development to that of health and agriculture etc. is described below.

Nuclear Power Development

As stated earlier, Pakistan originally embarked on a nuclear program for peaceful purposes and hence the Pakistan Atomic Energy Commission (PAEC) was established in 1956 as an institution responsible for the promotion of nuclear energy and research activities. Its establishment almost coincided with the creation of the IAEA. PAEC has two separate divisions, which look at nuclear power projects and power generation separately. The Nuclear Power Generation (NUPG) Directorate administers the operational units, with the design and construction aspects of the planned units being managed by the Nuclear Power Projects (NUPP) Directorate.

The technical cooperation between Pakistan and the IAEA can be traced backed to 1961, when the agency conducted a study on the feasibility of nuclear power in Pakistan upon the Government's request. Moreover, PAEC participated in Nuclear Power market surveys and later in 1975 a special study was conducted on long-term nuclear power planning for Pakistan.

The PAEC currently operates four nuclear power plants at two different sites.[13] The first reactor Karachi Nuclear power plant (KANUPP) commissioned in 1971 marked Pakistan's entry into nuclear power era. It is a 137 MWe pressurized heavy water reactor (PWR), which began operation under IAEA safeguards.[14]

The IAEA has also provided crucial assistance in ensuring the safety of the plant operation beyond its design life. To improve the safety features of KANUPP, a life extension project for the NPP entailed measures for plant degradation aversion due to

aging, introduction and adoption of modern operational practices and design improvement. The Balancing, Modernization and Rehabilitation (BMR) project ensured up gradation of conventional equipment and the Technical Up gradation Project (TUP) undertook to update the regulating Computers, Control and Instrumentation. The projects undertaken with IAEA's assistance have helped ensure the safe operation of KANUPP for 15 years beyond its design life.[15]

The Chashma Nuclear Power Plant site houses three operating PWRs with one still in construction phase. The CHASNUPP Unit I, 325 MWe reactor, has been associated with the IAEA since the very beginning and has benefited from the IAEA's assistance in its design, construction, installation, commissioning and operation phases. Furthermore, to ensure safety of Plant operation CHASNUPP has received Operational Safety review Team[16] (OSART) missions multiple times. For CHASNUPP-I a pre-OSART mission was conducted by IAEA in 1999 and later "a full-scope IAEA OSART Mission was conducted in January 2004.[17] Moreover, IAEA conducted an International Regulatory Review Team (IRRT) mission during the construction phase of the plant.

These reviews by international experts have been crucial in improving the operational safety of the plant, in strengthening the overall management practices and ensuring the safe and reliable operation of the plant with improved performance in plant operation. The IAEA has also been providing assistance for capacity building of the personnel through onsite training workshops and scientific visits etc., under various TCP programs.

Like C-I, CHASNUPP-II has benefited from comprehensive design safety review from IAEA international experts. Under the Preliminary Safety Analysis Report (C-2 PSAR) the IAEA conducted 13 missions – February 2005 to June 2006 - for the safety review of the design and several follow-up missions have been conducted. These review missions have contributed greatly in evaluating and improving the safety parameters of the plants. Alongside this, capacity building workshops have been offered by the IAEA to the C-2 personnel aimed at improving the Probabilistic Safety Analysis (PSA) capability of the team.

Nuclear Safeguards and Additional Protocol

All nuclear power plants of Pakistan have been under IAEA safeguards since their inception and Pakistan has ensured safe and reliable operation of these nuclear power plants (NPPs) throughout their lifetime, now spanning over a period of more than 50 plant years. Furthermore, Pakistan has concluded facility specific agreements with IAEA for all of its civilian nuclear power plants and research facilities. The first safeguards agreement was signed in March 1962 as a result of a trilateral safeguards agreement (INFIRC/34) for the supply of Pakistan Research Reactor-1 (PARR-1) supplied by the US under Atoms for Peace program.

Pakistan employs IAEA's item-specific or facility-specific safeguards, for its facilities i.e. INFIRC/66/Rev.2 and hence the agreement covers safeguards on all civilian nuclear research facilities and nuclear power plants. Generally, the agreements enter into force after the conclusion of a Project Agreement between

IAEA and Pakistan, after a unilateral submission by Pakistan or upon conclusion of a supply agreement for materials between two or more states.[18]

The PAEC's Division of Disarmament and Safeguards (D&S) acts as state-level safeguards office and provides IAEA with: the Design Information Questionnaire (DIQ) entailing details of design and operation of new nuclear facilities and material accountancy reports after scrutiny.

Furthermore, Pakistan also notifies to IAEA in cases when materials are transferred into Pakistan; new reactor facilities are built; about nuclear material in possession of a facility and nuclear materials that get transferred from a facility. For the effective compliance with the Safeguards regime, IAEA applies adequate containment and surveillance (C/S) procedures in the nuclear reactors or other civilian sites to control, monitor and ensure non-diversion during movement or access to nuclear materials. All CHASHNUPP Units as well as KANUPP have these C/S procedures installed. The IAEA inspectors carry out periodic routine inspections of the nuclear facilities on the basis of a predetermined schedule. The D&S division facilitates the agency in this process.[19]

Pakistan has been in full compliance with the agency's safeguards regime for over fifty years now. Pakistan's cooperative behavior in facilitating the IAEA mandate of non-diversion is well recognized by the agency.[20]

Apart from the IAEA safeguards agreements, the Additional Protocol provides supplementary tools to verify the peaceful

use of nuclear material and technology provided to the member states. IAEA's safeguards experience with Iraq and Democratic People's Republic of Korea (DPRK) in the early 1990s exposed the inadequacies of the safeguards regime to detect undeclared facilities. Therefore, the model Additional Protocol (AP) adopted by the IAEA BoG in May 1997,[21] laid down the standard for member states who wish to conclude an AP with IAEA. It is a voluntary arrangement that is binding only for states, which choose to make the undertaking (sign and ratify). Furthermore, the states that have item specific safeguards agreements can still choose to negotiate the provisions of the AP with IAEA.

Pakistan has item-specific safeguards agreement with the IAEA and could consider negotiating an additional protocol (AP) with the Agency on its own terms. While Pakistan has been considering negotiating the AP since 2005, progress was impeded by concerns that such an initiative might be too intrusive for a nuclear weapon state outside the Treaty for Non-proliferation of Nuclear Weapons (NPT). This being said, all nuclear weapon states have an AP in place that is subject to their national security imperatives. Moreover, India's conclusion of an AP has already set a precedent of negotiating an AP that is not too intrusive as India chooses which facilities to keep in or out of IAEA safeguards.[22] However, the value addition for Pakistan in undertaking this voluntary commitment will have to be examined. While India committed to AP as a reciprocal obligation in implementing the Indo-US nuclear deal; Pakistan can also benefit by undertaking the commitment, regardless of linking it with a quid-pro quo. As an aspirant for membership in multilateral export control regimes, taking on the commitment of an additional protocol, will

help enhance Pakistan's credentials for nuclear responsibility and its case for membership in multilateral export control regimes. In this regard, Pakistan would, of course, have to implement a separation plan for its civilian and strategic/military facilities.

Nuclear Safety

Pakistan has established an effective infrastructure to ensure the safety of nuclear materials as well as facilities and related equipment. The Pakistan Nuclear Regulatory Authority (PNRA) has been working as an independent regulatory and licensing body since 2001 and seeks to ensure the safe and reliable operation of nuclear facilities, and safety of nuclear materials and radiation sources in line with the IAEA's safety standards. PNRA has been actively collaborating with the IAEA and is a beneficiary of various capacity building programs and review missions from the IAEA.

Post Fukushima Daiichi incident in Japan in 2011, PNRA initiated the Fukushima Response Action Plan aimed at assessing and improving the safety parameters of Pakistan's NPPs.[23]With the assistance of IAEA, immediate and medium term measures are implemented to ensure safety of NPPs. Moreover, with program for expansion of nuclear power infrastructure, new NPPs planned for the Karachi site are known to have better safety features, based on their advanced designs (Generation-III). Furthermore, the IAEA has conducted several Operational Safety Review Team (OSART) Missions to ensure the safety and reliability of the Chashma plants as well as KANUPP.[24]

Nuclear Security

Nuclear security, for Pakistan, is a national responsibility that it takes very seriously. It has also been a coveted area of continuous cooperation between Pakistan and the IAEA. This elaborate cooperation includes security of nuclear installations/power plants, nuclear and radiological materials, their transport, capacity building of operators, handlers of nuclear/radiological materials and dealing with emergency preparedness and response.

Pakistan's nuclear security regime has already been covered in the other chapters of the book and hence some key aspects of Pakistan's cooperation with IAEA are touched upon here briefly. Pakistan has a specific nuclear security cooperation program with the IAEA since 2005, which has been further expanded to include security of nuclear power plants and cooperation. All nuclear medical centers with Category I radiological sources are upgraded for nuclear security through cooperation with the IAEA, with special emphasis on physical protection of radioactive materials in line with IAEA Code of Conduct on Safety and Security of Radioactive Sources. The cooperation extends to enhancement of the nuclear security systems consistent with global good practices and recommendations contained in IAEA nuclear security documents.[25]

The establishment of the nuclear emergency management system, at the national level, ensures the provision of technical guidance to licensees in case of nuclear and radiological emergencies, apart from undertaking trainings for first responders and emergency response personnel.

The Pakistan Centre of Excellence on Nuclear Security (PCENS) imparts training in various nuclear security disciplines including physical protection and personnel reliability in collaboration with National Institute of Safety and Security (NISAS) and Pakistan Institute of Engineering and Applied Sciences (PIEAS). The training activities are carried out in collaboration with the IAEA and PCENS is fast transforming into a regional and international hub on nuclear safety and security matters.[26] Furthermore, the PNRA also has a National Nuclear Security Action Plan (NSAP), implemented in collaboration with IAEA, which ensures the management of radioactive sources, security of orphan sources, radiation detection, and emergency preparedness and response.

Regulatory Infrastructure and Support

The PNRA, as an independent regulator has developed effective safety regulations to govern the safety and regulatory infrastructure. PNRA has ensured that the regulatory and statutory framework for radiation and waste safety is in accordance with the IAEA's Basic Safety Standards (BSS). The IAEA guidelines for ensuring safety standards are reflected in various regulations as well as implemented in all nuclear installations. Regulations related to General Radiation Protection, Licensing, Waste Management, Transport and Managing Radiological Emergencies are issued on the basis of guiding documents developed by PNRA.

According to the PNRA official website, it actively collaborates with IAEA not only for regulatory missions but also conducts training courses in other member states and provides assistance to IAEA in developing its documents and training material.

PNRA is a member of various committees and forums of IAEA that contribute to the promotion of nuclear safety; including the Nuclear Safety Standards Committee (NUSSC), Transport Safety Standards Committee (TRANSSC), Waste Safety Standards Committee (WASSC), Radiation Safety Standards Committee (RASSC) and the Committee on Safety Standards (CSS). In the Incident reporting networks like the International Nuclear Event Scale (INES) and International Reporting System (IRS), the PNRA serves as a national coordinator. PNRA contributes to the United Nations Scientific Committee on the Effects of Atomic Radiations (UNSCEAR), through sharing of information as well as relevant expertise.

Under the Regulatory Cooperation Forum (RCF), that shares its expertise with various states based on the IAEA safety standards, PNRA has been sharing regulatory knowledge and experience with member states, undertaking or with established nuclear power programs, to develop their regulatory capacity.[27]

Apart from the operational safety review, the IAEA's Integrated Regulatory Review Services (IRRS) mission inspects and reviews the regulatory procedures at the nuclear power plant sites in Pakistan. In this regard, IRRS conducted a mission in 2014, where some 21 experts alongside two coordinating persons from IAEA Headquarters conducted a review under a National TC Project on Radiation, Transport and Waste Safety. The team members visited the NPPs and their recommendations were subsequently incorporated in the regulatory framework.

Technical Cooperation Program

The IAEA technical cooperation program (TCP) draws its mandate from Article II of the statutes of the agency, i.e. "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world."[28] The strategic goal of the program is to promote, in a cost effective manner, the sustainable socio-economic development goals in the member states.[29]

The TC program is formulated through continuous mutual collaboration between the Secretariat and the member states, with an aim to achieve mutually agreed development needs and interest through technical cooperation activities. A CPF is an all-encompassing program that takes into account the United Nations Development Assistance Framework and devises a framework entailing the country's national development plans country specific analyses and experience from past cooperation. The program is spread over a period of five years.[30]

The IAEA's TC program with Pakistan is "amongst the largest in the world."[31] Pakistan has been a beneficiary of 153 National TC projects; 60 regional and 9 inter-regional projects in various fields from the TC program. Furthermore, 151 IAEA experts have performed expert missions in Pakistan between 2011 and 2014.

Industrial Applications

Under the IAEA/Regional cooperation Agreement Project (RCA), Pakistan has been participating in many training courses being offered to the industry related to Non-destructive Testing Services (NDT). The training is undertaken with the intent to raise core

groups of trainers who could impart training and certification to personnel and provide NDT services to the industry. In this regard, Pakistan established a National Centre for Non-destructive testing (NCNDT) in 1995 and the personnel trained through the IAEA collaboration have been providing their technical consultancy to the local industry, i.e. refineries, fertilizer plants, oil and gas industry, thermal and hydel power plants, railway sugar industry, airline industry, shipbuilding industry and nuclear power plants. The NCNDT has contributed through its training material to the IAEA's publications for the RCA member states.

Cooperation in other industrial applications includes the introduction of nuclear analytical techniques through Neutron Activation Analysis (NAA) which has greatly benefitted the industry. Moreover, the nuclear analytical laboratory at PINSTECH gained expertise in sample analysis through the agency sponsored Analytical Quality Control Services (AQCS) program.

Pakistan has also greatly benefited through RCA programs focusing on radiotracers and nucleonic control systems for process optimization and troubleshooting of leakages in industrial sector. Moreover, the knowledge transfers through IAEA have helped in establishment of Pakistan Radiation Services (PARAS); a Gamma irradiation facility that conducts sterilization of medical products.

Food, Agriculture and Biotechnology

Agricultural sector has an undeniable primacy in Pakistan's economy. It retains the highest priority in terms of development plans and hence the PAEC was assigned the task of employing

nuclear techniques to supplement the conventional means of agricultural research. The PAEC has four institutions that serve the cause of improving agricultural practices through various programs dedicated to mutation breeding, salinity and water logging, soil sciences, food irradiation etc.

Nuclear Institute for Agriculture and Biology (NIAB) and Atomic Energy Agricultural Research Centre (AEARC) Tandojam, were the recipients of the UNDP/IAEA project, on mutation breeding, in the early seventies. The project helped the country in improving the cotton crop yield, which is a principle cash crop of the country. A radiation-induced variety of cotton, NIAB-78 was introduced to the farmers, which revolutionized cotton production during the 1980s. To fight different type of crop viruses that were affecting production, the agency helped National Institute for Biotechnology and Genetic Engineering (NIBGE), evolve virus resistant varieties.

Salinity is another major challenge for the canal-irrigated areas in Pakistan. To address this challenge, PAEC sought support from the agency to reclaim saline soils through biological methods. The success of the project later led the agency to transform it into an inter-regional IAEA model project among seven states, i.e., Morocco, Tunisia, Syria, Iraq, Iran and Myanmar; for reclamation and utilization of the saline wasteland.[32]

Biotechnology has contributed to Pakistan's agriculture by improving the crop production and leading to poverty alleviation. NIBGE, which undertakes research and development in agriculture, health, environment and industry, was established with IAEA's

assistance. Under a coordinated research project (CRP) with the IAEA, NIBGE developed bio-fertilizers for legumes and cereals. Furthermore, NIBGE has also been successful in developing molecular diagnostic techniques for infectious diseases, which were provided to hospitals for the benefit of the general public.

IAEA's assistance also led PINSTECH to establish laboratories to study and employ isotopic techniques in hydrology. Essential usage included use of isotopic techniques and radiotracers for investigating water logging problems, seepage issues in dams and measuring groundwater flow velocity around CHASNUPP nuclear site.

Human Health

In health sector, the diagnosis and treatment of cancer has been a major issue for Pakistan. As is acknowledged in Pakistan's official statements to the IAEA General Conference, the agency provided Pakistan assistance in initiating the country's nuclear medicine program.[33] Pakistan's first atomic energy medical center was established in 1960 in Karachi. Currently Pakistan operates some 18 nuclear medical centers, which are providing these services. These centers provide services in nuclear medicine, radiotherapy, diagnostic imaging studies and radioimmunoassay.[34] The agency assisted PAEC in upgrading the services at different medical centers like

- Establishing Radiotherapy services in Jamshoro in 1962 (especially installation of Cobalt-60 tele therapy machine)

- Introduction of nuclear cardiology at Atomic Energy Medical Centre (AEMC), Jamshoro and NORI Islamabad. In 2011, PAEC equipped AEMC with latest technology of nuclear medicine and radiation therapy. The institute would now be able to cater to twice its former capacity, i.e. 60,000 patients.[35]

- Establishment of a Secondary standard dosimetry laboratory at PINSTECH, which provides services for dosimetry calibration as well as radiation beam output measurements to various radiotherapy institutes in the country.

The agency supported PINSTECH for establishment of a centralized national facility for production of high quality radiopharmaceutical kits. The facility provides these to the nuclear medical centers in the country.

CONCLUSION

In summation, Pakistan's cooperation with the agency has not only been multifaceted but also mutually beneficial. The momentum of this cooperation has successfully been sustained by Pakistan at the political as well as the technical level. Pakistan features prominently in IAEA as a member state that has offered its services, trained manpower, nuclear safety security and regulatory experience to the agency in promoting its role for peaceful uses of nuclear science and technology. Moreover, the agency's cooperation with Pakistan has been crucial in making available the resources and technical base to advance the uses of peaceful nuclear technology i.e. industrial applications, nuclear medicine, agriculture, food and human health etc. Pakistan and IAEA cooperation is a positive

chapter in any discussion of bilateral cooperation of the agency with a member state.

Notes

[1]"Address by Dwight D. Eisenhower, President of the United States of America, to the 470th Plenary Meeting of the United Nations General Assembly", 8 December 1953, available at https://www.iaea.org/about/history/atoms-for-peace-speech

[2]David Fischer, *History of the International Atomic Energy Agency: The First Forty Years*, (Vienna: IAEA, 1997), p.10, available at http://www-pub.iaea.org/MTCD/publications/PDF/Pub1032_web.pdf

[3]Ibid, pp.9-12.

[4]Ibid.

[5]Ibid, pp. 33-35.

[6]Article II, IAEA Statute.

[7]Article V, The Statute of the IAEA.

[8]The Board consists of 35 representatives from following eight geographical regional groups: i.e., North America, Latin America, Western Europe, Eastern Europe, Africa, Middle East and South Asia, South East Asia and the Pacific and Far East.

[9]Article VI, The Statute of the IAEA.

[10]Three PAEC Chairman, chaired the BoG, representing Pakistan, in 1962-63, 1986-87 and 2010-11.

[11]Islamic Republic of Pakistan, Fact Sheet, International Atomic Energy Agency website, available at https://ola.iaea.org/ola/FactSheets/CountryDetails.asp?country=PK

[12]"Pakistan signs a Country Program Framework (CPF) for 2014-2019", IAEA official website, available at https://www.iaea.org/technicalcooperation/Home/Highlights-Archive/Archive-2013/09192013_CPF_Pakistan.html

[13]"Nuclear Power", Pakistan Atomic Energy Commission Official Website, available at http://www.paec.gov.pk/NuclearPower/

[14]"Country Nuclear Power Profile: Pakistan 2013", International Atomic Energy Agency, 2013, pp.9-11, available at http://www-pub.iaea.org/MTCD/publications/PDF/CNPP2013_CD/countryprofiles/Pakistan/Figures/CNPP%20PAKISTAN%202013.pdf

[15]Ibid, p.11.

[16]The OSART missions of the IAEA conduct review of operational safety performance at nuclear power plants, in coordination with internationally based team of experts. For details see https://www.iaea.org/newscenter/news/osart-programme

[17]"Islamic Republic of Pakistan: Fourth National report for the Convention on Nuclear Safety", Pakistan Nuclear Regulatory Authority, September 2007, available at http://www.pnra.org/upload/reports/Pakistan-4NR.pdf

[18]Salem Khan, Muhammad Saeed Mulla, "Safeguards in Pakistan – State-Agency Cooperation", International Atomic Energy Agency, p.2, available at https://www.iaea.org/safeguards/symposium/2014/home/eproceedings/sg2014-papers/000371.pdf

[19]Ibid, p.4.

[20]"IAEA 'completely satisfied' with Safeguard measures of Pakistan Nuclear Program", *The Nation*, 27 September 2015, available at www.nation.com.pk/national/27-Sep-2015/iaea-completely-satisfied-with-safeguard-measures-of-pakistan-nuclear-program.

[21]Additional Protocol", International Atomic Energy Agency, available at https://www.iaea.org/safeguards/safeguards-legal-framework/additional-protocol

[22]For details see Hajira Asaf Khan and Majid Mahmood, "IAEA Protocol: Prospects and Challenges for Pakistan", *CISS Insight*, Issue1:Vol 4 (March 2016), pp. 17-35, availabel at http://ciss.org.pk/wp-content/uploads/2016/05/2-

Article-Majid-Hajira-1.pdf

[23]"Annual Report: 2012-2013", Pakistan Atomic Energy Commission, p. 7.

[24]"Nuclear Safety & Security", Mission Calendar, International Atomic Energy Agency (IAEA), available at http://www-ns.iaea.org/actionplan/missions.asp?mt=OSART&my=All&cn=Pakistan&ms=Completed&submit.x=17&submit.y=8&func=search.

[25]"Pakistan's National Statement: Nuclear Security Summit", Nuclear Security Summit: Washington 2016, 01 April 2016, available at http://www.nss2016.org/document-center-docs/2016/4/1/national-statement-pakistan.

[26]Aabha Dixit, "Pakistan's National Centre of Excellence Contributes to Sustaining Nuclear Security", IAEA Office of Public Information and Communication, 18 January 2017, available at https://www.iaea.org/newscenter/news/pakistans-national-centre-of-excellence-contributes-to-sustaining-nuclear-security

[27]"International Cooperation", Pakistan Nuclear Regulatory Authority official website, available at http://www.pnra.org/int-cooperation.html.

[28]Article II, The Statute of the IAEA.

[29]"Technical Cooperation Programme", International Atomic Energy Agency Official Website, available at https://www.iaea.org/technicalcooperation/programme/index.html

[30]"Country Programme Frameworks", International Atomic Energy Agency Official Website , available at https://www.iaea.org/technicalcooperation/programme/Prog-Man/CPFs.html.

[31]"IAEA 'completely satisfied' with Safeguard measures of Pakistan Nuclear Program", *The Nation*, 27 September 2015, available at www.nation.com.pk/national/27-Sep-2015/iaea-completely-satisfied-with-safeguard-measures-of-pakistan-nuclear-program.

[32]For details see Bill Wallin, Jorge Morales Pedraza, "Seeds of Life: How wastelands become fertile fields", (IAEA Bulletin: Vol. 45-1, June 2003), available at https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull45-1/45105434753.pdf

[33]"Statement by the Leader of Pakistan Delegation", 56th IAEA General Conference, 7-21 December 2012, p.2, available at https://www.iaea.org/About/Policy/GC/GC56/Statements/pakistan.pdf.

[34]"Cancer Hospitals: Nuclear Medicine and Oncology", Pakistan Atomic Energy Commission Official Website, available at http://www.paec.gov.pk/Medical/.

[35]"Atomic energy: Nuclear medical centre opens at JPMC", *The Express Tribune*, 13 January 2011, available at http://tribune.com.pk/story/102884/atomic-energy-nuclear-medical-centre-opens-at-jpmc/.

CHAPTER: 8

PAKISTAN'S PROSPECTIVE NUCLEAR FORCE POSTURE IN 2025*

Naeem Salik

Background

Pakistan's nuclear posture and the size of Pakistan's nuclear arsenal have been subjects of considerable speculation and debate since Pakistan first tested nuclear weapons, and increasingly so in recent years. Within the vast debate, however, many outside Pakistan seem to have agreed that Pakistan has the fastest growing arsenal in the world.[1] Alarmists estimate that by 2025, Pakistan will become the third-largest nuclear weapon power, leapfrogging ahead of France, China, and the United Kingdom, behind only the United States and Russia.[2] Others conjecture that its growth will make it only the fifth-largest arsenal.[3] Even the best of these estimates are still highly speculative, based on assumptions about

Pakistan's goals, the capacity and efficiency of Pakistan's nuclear materials production facilities, its ability to convert these materials into weapons components, and its ability to build an inventory of adequate numbers of delivery systems. Estimates also assume that 100 percent of available fissile material is being converted into weapons, and that Pakistan's reprocessing and weapons core fabrication can keep pace with the production of plutonium at the Khushab nuclear complex. These estimates draw criticism and angry responses from Pakistani officials, but a vast majority of the people in Pakistan feel elated reading such reports. The people of Pakistan might be disappointed to learn that, contrary to the prevailing perceptions, the size of Pakistan's arsenal is, and will remain, substantially smaller than recent reports published in the United States suggest.

So much agreement exists around incorrect estimates of Pakistan's nuclear arsenal because of a paucity of primary source data. Most estimates rely on a few common sources, such as the *Bulletin of Atomic Scientists*, periodic reports by the International Panel on Fissile Materials (IPFM), the Stockholm International Peace Research Institute (SIPRI) yearbooks, assessments by the Institute of Science and International Security (ISIS), and occasional reports by the Federation of American Scientists (FAS) and the Nuclear Threat Initiative (NTI). These reports in turn rely on each other to corroborate their estimations, which means that, the same data are recycled repeatedly. The appearance of broad consensus comes from circular corroboration, not repeated independent verification. The resulting consensus picture shows Pakistan as a state obsessed with building as many nuclear weapons as it can in as short a time as possible, totally oblivious to the deleterious

effects of such an undertaking on its economic health and the regional security environment. This picture, though inaccurate, affirms the suspicion with which Western observers have viewed Pakistan's nuclear program since its inception. The Pakistani military's predominant role in the management of the Pakistani nuclear program leads these same observers to perceive the Pakistani nuclear program as overly militaristic and aggressive in nature, while at the same time trusting that India's program is moving at a leisurely pace, and that its growth is justifiable in light of the twin threat from China and Pakistan. Most observers tend to discount the weaponization potential of India's enriched uranium stockpiles, which are simply put aside as fuel for India's nuclear-powered submarines. They even fail to take into account reports emerging since 2012 about the construction of a large enrichment facility in Karnataka that would considerably increase India's enriched uranium production capability and, in turn, its weapons fabrication capacity. The reality of Pakistan's nuclear posture is quite different from this consensus perception.

Another factor that prevents statistical analyses from reflecting the true state of Pakistan's nuclear program is the artful picking and choosing of data to support the conclusions at which one intends to arrive. Some very obvious facts are simply ignored because they are apparently not in conformity with the desired inferences. Although Pakistan, like India, has not made its inventory of fissile materials or warheads public, officials in Pakistan often comment on various studies and reports on the issue to call them inaccurate, exaggerated, or propagandistic. This paper will attempt to challenge some of the assumptions made by observers outside of Pakistan, and will try to provide an alternative and more realistic

assessment of Pakistan's current and future nuclear force structure within the constraints imposed by a lack of information in the public domain.

Beginnings of the Nuclear Doctrinal Debate

Pakistan's nuclear force structure is a consequence of the country's nuclear doctrine. Tracing Pakistan's doctrine over the last twenty years will, therefore, provide the context necessary to evaluate the veracity of Western estimates about the growth of Pakistan's nuclear arsenal and will lay the groundwork for a more comprehensive understanding of Pakistan's current and future force postures.

Prior to the overt demonstration of its nuclear capability in response to Indian nuclear tests in May 1998, Pakistan pursued a policy of ambiguity, denying the existence of a nuclear weapons program. This policy helped mitigate some of the international pressures, but by doing so it foreclosed the possibility of public discourse on Pakistan's future nuclear doctrine. Even once the doctrine was outlined after the 1998 nuclear tests, Pakistan remained silent about the goals of its weapons program. Only after India announced its Draft Nuclear Doctrine in August 1999 did Pakistan's government feel any serious pressure to publish its own doctrine. Three former government officials—foreign secretary Agha Shahi, air chief Zulfiqar Ali Khan, and foreign minister Abdul Sattar—jointly authored a newspaper article in October 1999 making the case for a minimum deterrence posture[4] They cautioned against squandering Pakistan's limited economic resources to build an arsenal that exceeded Pakistan's security needs, all in the name of winning a pointless competition against

India. They advocated a posture that ruled out the possibility of nuclear war fighting on account of the large size and resource disparity between India and Pakistan, and argued that, since deterrence was the sole aim of the nuclear program, a small arsenal would suffice.[5] Though the article was the first public statement on the nuclear program's goals, the phrase most associated with Pakistan's nuclear doctrine, "credible minimum deterrence," never appears. Instead, the article recommended a minimalist approach in line with the common conception of "minimum deterrence," while perhaps contradicting itself by insisting on the dynamic nature of the concept and opening up the possibility of an ever-expanding arsenal:

> Minimum deterrence has been and should continue to be the guiding principle of Pakistan's nuclear pursuit. Of course minimum cannot be defined in static numbers. In the absence of mutual restraints, the size of Pakistan's arsenal and its deployment pattern have to be adjusted, to ward off dangers of pre-emption and interception. Only then can deterrence remain efficacious.[6]

The argument in support of minimum deterrence and a flexible force structure was reiterated by Abdul Sattar once he became foreign minister in the government of Pervez Musharraf. Indian decision makers adopted a similar approach, evident from former minister of external affairs Jaswant Singh's argument that, as the security situation changes, the number of weapons required for minimum deterrence will also change.[7] Eventually, both India and Pakistan added the word credible to their minimum deterrence postures, indicating their discomfort with the minimal size of their respective arsenals. According to nuclear policy expert Rodney Jones, "the term *credible* is a much more demanding criterion than

'minimum' deterrence might imply by itself."[8] The flexibility that "credible" provides effectively means that the nuclear doctrines of both India and Pakistan have allowed for reasonably large nuclear arsenals since the beginning of their respective nuclear programs.

Pakistan's Evolving Nuclear Posture

Pakistan seeks to use its nuclear capability not only to counter the nuclear threat that India poses but its conventional advantage as well—Pakistan seeks a full spectrum minimum deterrence rather than merely nuclear deterrence. In the decade following the 1998 tests, Pakistan was able to achieve these objectives by maintaining a credible minimum deterrence posture through three major crises in 1999, 2001–2002, and 2008. India's former external affairs minister, acknowledged the role of nuclear weapons in creating parity between India and Pakistan, stating at a forum that "the 1998 nuclear tests by India conferred a kind of parity to Pakistan that it had always sought."[9] While Pakistan's nuclear capability buys a level of parity that Pakistan could not afford to create with conventional forces, the imperative to deter a broad spectrum of threats imposes more exacting demands on Pakistan's nuclear deterrent posture and makes it sensitive to the changes in India's conventional force structures and doctrines. This sensitivity explains Pakistan's strong reaction to India's Cold Start, or proactive operations, doctrine. As pointed out by Maleeha Lodhi, "Western analysts have often depicted this [Pakistan's enhancement of its nuclear capability] as a mindless, irrational drive motivated by the unbridled ambitions of the nuclear scientific-military lobby."[10] Lodhi further argues that the issue of Pakistan's nuclear arsenal cannot be divorced from its context, specifically "the chain of

rapid developments that have undermined the region's strategic equilibrium and affected Pakistan's nuclear threshold."[11] Among these developments, she has listed the US-India Civil Nuclear Agreement, the Nuclear Suppliers Group waiver obtained by India, the continuing growth of India's conventional and strategic capabilities, India's espousal of offensive war fighting doctrines such as the proactive operations doctrine, and concerted efforts to acquire a missile defense capability.[12]

In the aftermath of its overt nuclear tests in 1998, Pakistan set rather modest force goals in line with its policy of credible minimum deterrence, aiming for an arsenal of fewer than 100 weapons. In an often-quoted interview from January 2002, the director general of Pakistan's Strategic Plans Division, Lieutenant General Khalid Kidwai, added constraints to the doctrine, stating that Pakistan had no plans "for now" to develop battlefield nuclear weapons such as nuclear artillery.[13] Pakistan circa 2002 may not have felt any compelling operational need to develop tactical nuclear weapons (TNWs), but abstaining from TNWs could also have been a consequence of technological deficiencies, such as a dearth of fissile material or the inability to create suitably miniaturized warhead designs. Given the well-considered choice of a credible minimum deterrence posture, though, TNWs simply would not have made sense as part of Pakistan's nuclear posture in the years immediately after 1998.

Dichotomy in Declaratory and Operational Postures—Rationale and Ramifications:

In 2011, tests of a short-range missile called the Nasr (Hatf-IX)

came as a surprise to many, especially because an official press release announced that the 60-kilometer-range missile was capable of carrying "nuclear warheads of appropriate yield."[14] Introduction of the short-range, battlefield-usable weapons by Pakistan triggered an animated debate, both in Pakistan and abroad. Those with a sympathetic view of Pakistan's position have argued that the Nasr is a logical response to India's provocative Cold Start war doctrine.[15] Senior Pakistani officials have been quoted as saying that the Nasr is meant to pour cold water over Cold Start.[16] Critics, on the other hand, view the Nasr as a destabilizing development that increases the probability of a nuclear war in South Asia.[17] Debate aside, there is no doubt that Pakistan has embarked upon the development of battlefield nuclear weapons capability. Pakistani government spokespersons, though, continue to tout Pakistan's policy of credible minimum deterrence, which is a form of the so-called simple punishment model of deterrence, unlike the deterrence by denial—or war fighting model of deterrence—enabled by the use of battlefield nuclear weapons. These models have very different demands in terms of the size of arsenals, command and control, and battlefield management. However, this apparent dichotomy in the declared doctrine and actual force posture has yet to be clarified by Pakistani strategic planners.

The pandemonium created by the short range of the Nasr weapon system and perception of problems related to maintaining effective centralized command and control, not to mention the physical security of the missile launchers once operationally deployed in the field, diverted public attention away from some very important implications.

More important than the much-discussed range of the missile is the accompanying development of a sleek and miniaturized warhead to be mounted on it. This technological achievement has far-reaching implications, since it will enable Pakistan to arm its Babur (surface-launched) and Raad (air-launched) cruise missiles with nuclear warheads. It will also make it possible for Pakistan to equip naval platforms with nuclear weapon systems. The debate around Pakistan's introduction of battlefield nuclear weapons has also remained narrowly focused on the Nasr's technical attributes, ignoring the operational characteristics of the other short-range systems, such as the 180-kilometer Abdali missile. Pakistan believes that the Nasr demonstrates a capability that will strengthen deterrence through option enhancement and threat manipulation. Lieutenant General (retired) Khalid Kidwai, speaking at the Carnegie International Nuclear Policy Conference in 2015, strongly criticized the narrow focus of the debate, stating that:

I strongly believe that by introducing the variety of tactical nuclear weapons in Pakistan's inventory, and in the strategic stability debate, we have blocked the avenues for serious military operations by the other side. That the debate has been hi-jacked towards the lesser issues of command and control, and the possibility of their falling into wrong hands is unfortunate, because it has distracted and diverted attention from the real purpose of the TNWs, that of reinforcing deterrence, preventing war in South Asia, ensuring peace, thereby creating an enabling environment for politics and politicians to reassert and lead the way towards conflict resolution, and give South Asia and its people a chance.[18]

Without denigrating the arguments of the Nasr's critics, one needs to look into the factors that compelled Pakistan to go down this treacherous path. India has been persistently challenging the credibility of Pakistan's nuclear deterrent doctrinally, technologically, and practically. It has been insisting since February 2000 that there is a space below the nuclear threshold for a limited conventional war with Pakistan. Kidwai alluded to this, arguing that:

> For 15 years I, and my colleagues, at the Strategic Plans Division in Pakistan, worked for deterrence to be strengthened.... to create roadblocks in the path of those who thought that there was space for conventional war, despite the nuclear weapons of Pakistan.... what was probably encouraging them to find the space for conventional war, below this gap, was the absence of a complete spectrum of deterrence.... That there was some kind of a gap in their realization at the tactical level, and therefore it was leading to this encouragement... on the other side [in India] that there was space for conventional war.... Because war was being brought down under the Cold Start Doctrine to the tactical level.... Therefore, the idea of Nasr was born [out of the] need to plug this particular gap.[19]

Pakistan's development and field testing of the Abdali (Hatf-II) and the Nasr (Hatf-IX) seem to be in keeping with the counsel given by Michael Quinlan, a highly respected British nuclear expert, who has argued that "The range of options available must, therefore, be an unmistakable continuum without huge gaps. That in turn meant that there had to be nuclear forces, backed by will and doctrine for their possible use, intermediate between conventional forces... and the ultimate strategic nuclear capability."[20] During the Cold War, NATO's political and geographical compulsions along the central front in Germany, which constrained its ability to give

up any space in a conflict even for sound operational reasons, forced it to adopt a forward defense posture. In contemporary South Asia, Pakistan faces a similar dilemma. Pakistan can justifiably draw a comparison between NATO's compulsions and its own situation. It, therefore, feels compelled to promise a high probability of nuclear use in the event of a military conflict with India. Pakistan, thus, has all the basic building blocks of what it describes as full spectrum deterrence, and it is only a matter of time before missile systems, both at the shortest- and longest-range ends of the spectrum, will be available in sufficient numbers to put full spectrum deterrence into practice. However, not unlike the fluctuations in the US nuclear posture between simple punishment and war fighting, Pakistan's doctrinal evolution will not be linear.[21]

The transformation in Pakistan's strategic posture has not been brought about merely by India's continued quest to find a space for a limited conventional war. The prolonged commitment of almost one-third of Pakistan's military forces in counter-terror or counter-insurgency operations in the tribal areas along its borders with Afghanistan has thinned Pakistan's deployments along the eastern border, creating a feeling of vulnerability that India can easily exploit. India has also adopted a belligerent posture along the Line of Control in Kashmir, especially across the working boundary in the Jammu-Sialkot sector. By perpetually keeping these borders hot and adding further psychological pressure on Pakistan, India forces Pakistan toward greater reliance on its nuclear capability and lowering of its nuclear threshold.

Conceptually, credible minimum deterrence and full spectrum

deterrence are different from each other in terms of both their goals and the force requirements necessary to achieve those goals. Whereas credible minimum deterrence is essentially a variety of simple punishment deterrence (with weapons mainly aimed at counter value targets, and relatively limited force requirements), full spectrum deterrence is a kind of deterrence by denial, more akin to the flexible response or graduated response doctrines. Full spectrum deterrence targeting would include battlefield (counterforce) targets and would, therefore, require a larger arsenal size and a greater variety of both warheads and delivery systems. It would also require comparatively higher operational preparedness levels than the minimum credible deterrence posture. Pakistan's resource constraints and the continued insistence by official spokespersons on credible minimum deterrence as the existing policy, though, likely mean that Pakistan may not go all the way to a fully operational nuclear war fighting posture or deterrence by denial, and may instead settle for something intermediate between the two postures in the next ten years.

Though Pakistan has the advantage of learning from other states, it is still too early for it to have found definitive answers to its nuclear dilemmas. The current situation should, therefore, be considered a transient phase in Pakistan's evolving doctrinal thinking. It is also important to recognize that India and Pakistan are in a very close dyadic nuclear relationship and, given their historic rivalry dominated by the action-reaction syndrome it is obvious that one country cannot remain oblivious to the developments in the other.

The logic of dynamic and flexible deterrence that constantly adjusts to any expansion in the adversary's arsenal seems contradictory to

the common conception of minimum deterrence, and could lead India and Pakistan toward an unintended arms race. It also opens up the possibilities of an open-ended increase in the number of nuclear weapons held by both countries. Lieutenant General Kidwai, responding to a question during his 2015 Carnegie International Nuclear Policy Conference appearance, said that Pakistan had identified appropriate numbers to meet its minimum deterrence needs and these numbers were achieved in the recent past. However, the adoption of full spectrum deterrence, in response to the Cold Start doctrine, introduced a new dynamism in the program and led Pakistan to revise its estimates for the necessary numbers of weapons. Kidwai, however, reiterated that these revised numbers should suffice for the next ten to fifteen years, adding that "beyond a certain number you lose the logic, it's not an open ended race."[22] This statement clearly indicates that Pakistan's nuclear build-up has finite limits and is not likely to reach the level of the third-largest or even the fifth-largest nuclear power, as suggested by some analysts.

Myth of the Fastest Growing Nuclear Arsenal:

Pakistan's nuclear program has been stereotyped since its inception. It was first characterized as the so-called Islamic bomb. Then, after 9/11, it was dubbed the most insecure and vulnerable arsenal, just waiting to fall into the wrong hands. In the past few years, it has been commonly described as the fastest growing nuclear arsenal in the world. Given the scope of this publication, it is necessary to analyze only the last of these myths about the Pakistani nuclear arsenal. The five recognized nuclear weapon states (under the Non-Proliferation Treaty) ceased any further

production of weapons-grade plutonium by 1995 and highly enriched uranium (HEU) by 1996. Consequent to the New START (Strategic Arms Reduction Treaty) agreement, the United States and Russia are maintaining slightly less than 1,600 operationally deployed strategic nuclear warheads each. The United Kingdom has reduced its arsenal to around 225 warheads and plans further cuts, while the number of Chinese and French weapons is stable at 250 and 300 weapons respectively. The Israeli nuclear weapons program remains shrouded in mystery—estimates of the size of its nuclear arsenal range from 80 to 200 warheads—and North Korea holds a small number of weapons. India and Pakistan are the only countries in the world still building up their nuclear arsenals and fissile material stockpiles. They are the only two countries currently engaged in a nuclear arms race—or, to be fair, in a nuclear arms competition.[23]

Neither India nor Pakistan has ever declared how many warheads they maintain, or how much fissile material they have. All the estimates found in various publications are speculative. Even the most professionally calculated quantities of fissile material make estimates based mainly on the capacities of the production facilities in the two countries, and are forced to make assumptions about many functional parameters. For instance, a 50-megawatt plutonium production reactor working at 100 percent capacity can produce 18.25 kilograms of plutonium per year. However, these plants normally run at a much lower capacity and most calculations use a baseline of between 60 percent and 70 percent capacity. Running at this capacity, a 50-megawatt plant will produce around 11 to 13 kilograms per year, assuming that it can maintain the same efficiency through the entire 365 days. In practice, however,

the plants may run as low as 40 percent to 50 percent capacity, producing up to 7 to 9 kilograms per year. Moreover, the reactors cannot run 365 days per year. Reactors shut down for refueling and routinely face technical snags, which are not accounted for in existing calculations. Calculating HEU production is even more complicated because analysts must guess the actual number of centrifuges in a particular plant, the enrichment capacity of each centrifuge (which is dependent on the diameter and height of each machine), the quality of the feed material, and whether the rotor is made of aluminum, maraging steel, or carbon fiber. None of these factors can be accurately estimated without intrusive inspections.[24] Finally, it is hard to estimate what proportion of each country's fissile material has been fabricated into warheads and what proportion is still being processed, or is being kept as reserve for future eventualities, including conversion into more weapon cores.

The amount of fissile material needed for a warhead is also a variable, dependent on the sophistication of weapon designs. The amount of fissile material per warhead that a given study assumes has a direct bearing on the bottom-line result for the estimated arsenal size that that study will find. For instance, the Global Fissile Material Report (GFMR) estimates that Pakistan currently possesses 170 kilograms of plutonium. If the GFMR assumed that Pakistan needed 6 kilograms of plutonium per weapon instead of 4 kilograms, it would make a significant difference in their final estimate; with 4 kilograms per warhead, the estimate would be 42 warheads, but with 6 kilograms per warhead, the estimate would drop to 28. The same clearly holds for HEU warheads; whether a Pakistani HEU-based warhead requires 15, 20, or 25 kilograms

of HEU drastically changes the potential size of Pakistan's arsenal. Compared to the thousands of nuclear tests conducted by great powers during the Cold War, India and Pakistan have only conducted six tests each. Neither has enough data to develop highly sophisticated weapon designs requiring lesser amounts of fissile material. It is, therefore, highly unlikely that the estimated size of Indian or Pakistani arsenals comport with reality. Another problem is that these studies, while categorizing India's entire substantial stockpile of HEU as potential fuel for India's nuclear-powered submarines, do not address Pakistan's future HEU needs for naval propulsion. Pakistan is striving to develop the naval leg of its nuclear triad, which would ultimately include naval vessels propelled by nuclear fuel.

Leaving aside all the above-mentioned problems with methods for estimating nuclear arsenal sizes, data available from some of the more credible and widely quoted sources suggest that characterizing Pakistan's nuclear force as the fastest growing arsenal in the world is totally unjustified.[25] Data from the *Bulletin of Atomic Scientists*, SIPRI, and the GFMR clearly show that between 2007 and 2015, India and Pakistan's arsenals grew at exactly the same number of warheads per year (see Tables 1–3). This alone should suffice to debunk the myth of the fastest growing arsenal in the world.

Table 1

Bulletin of Atomic Scientists – Estimates of Indian and Pakistani Nuclear Warheads		
Year	India	Pakistan
2007	50	60
2008	60	70
2009	70	80
2010	80	90
2011	90	100
2012	100	110
2013	110	120
2014	120	130
2015	110–120	110–130

"Pakistani Nuclear Forces, 2015," *Bulletin of the Atomic Scientists* 71, no. 6 (November 2015): 59–66.

Table 2

SIPRI Estimates of Indian & Pakistani Nuclear Warheads		
Year	India	Pakistan
2010	60–80	70–90
2011	70–90	80–100
2012	80–100	90–110
2013	90–110	100–120
2014	90–110	100–120
2015	90–110	100–120

Data from SIPRI Yearbooks 2010–2015. See, for example, *Stockholm International Peace Research Institute, SIPRI Yearbook 2015: Armaments, Disarmament and International Security* (Oxford: Oxford University Press, 2015).

Table 3

Global Fissile Materials Report (GFMR) Estimates of Indian & Pakistan Nuclear Warheads		
Year	India	Pakistan
2007	50	60
2009	60-70	70-90
2011	80-100	90-110
2013	90-110	100-120

International Panel on Fissile Materials, Global Fissile Materials Report 2007 (Princeton, NJ: International Panel on Fissile Materials, 2007).

Anomalies in the Available Estimates:

Table 4 below provides estimates of the fissile material stockpiles of India and Pakistan. This table provides a confusing picture at best. For instance, India's military plutonium stocks grew from 0.52 metric tons in 2007 to 0.7 metric tons in 2009, but were back to 0.52 metric tons in 2011. In the same time period, the non-military plutonium stocks declared strategic (rather than civilian) by India rose from 5.4 metric tons in 2007 to 6.8 metric tons in 2009, before declining again in 2011 to 4.2 metric tons. Pakistan's plutonium stocks show a steady growth between 2007 and 2015. However, Pakistani HEU stocks jumped from 1.3 metric tons in 2007 to 2.1 metric tons in 2009, and then grew more modestly to 2.7 metric tons in 2011 and 3.0 metric tons in 2013. These stocks grew to 3.1 metric tons by 2015. Throughout this period, there was no evidence of new enrichment plants or facilities to produce feed material for these plants. It is hard to imagine that India's output of HEU could increase so rapidly without new infrastructure. Yet,

India's HEU stocks seem to have grown exponentially from 0.2 metric tons in 2007 to 3.2 metric tons in 2015. The GFMR authors do not explain these substantive fluctuations in estimates.

Another important statistic that receives too little attention is the comparative size of Indian and Pakistani HEU inventories. According to the 2015 International Panel on Fissile Materials (IPFM) report, India has 3.2 metric tons of HEU compared to Pakistan's 3.1 metric tons. Pakistan's nuclear weapons program was based entirely on HEU until 1999, when the first plutonium production reactor at Khushab became operational. India's program has been plutonium-based since its inception. There is a common tendency to ignore India's HEU stocks while estimating India's nuclear weapons potential, under the assumption that India's HEU stocks are meant for naval propulsion. A stockpile of 3.2 metric tons, though, is far more than India's naval nuclear reactors could possibly use. Each submarine, for example, requires a fuel load of only 200 kilograms of 30 percent enriched uranium. Though India has no real need for more HEU, the rare materials plant (RMP) at Rattehali near Mysore is continuing to churn out more. In short, India has a large surplus of HEU available for making nuclear warheads, and, therefore, the ability to grow its arsenal much faster than Pakistan.

It is also worth mentioning how large the margins of error are for estimates of India and Pakistan's fissile material stockpiles. Pakistan's HEU inventory, for example, is estimated at 3 metric tons with a probable error of ($\pm$ 1.2 metric tons). The actual amount could be anywhere from 1.8 metric tons to 4.2 metric tons. To put the margin of error in terms of weapons, a range of 1.8 metric

tons to 4.2 metric tons is a range of 60 20-kilogram warheads. Given that the available data have such serious shortcomings, no one can declare with any degree of certainty that Pakistan will become the third- or fifth-largest nuclear power in the world, or ascribe adjectives like "fastest growing" with any authority. Such unrealistic inferences drawn from suspect data lead to erroneous conclusions and poor predictions of the strategic environment likely to prevail a decade from now.

Table: 4[26]

Global Fissile Material Report - Estimates of Indian & Pakistani Fissile Material Stocks

Year	India	Pakistan
2007	Plutonium: 0.52 metric tons (5.4 metric tons, Strategic) HEU: 0.2 metric tons	Plutonium: 0.064 metric tons HE : 1.3 metric tons
2009	Plutonium: 0.7 MT (6.8 metric tons, Strategic) HEU : 0.6 metric tons	Plutonium: 0.1 metric tons HE : 2.1 metric tons
2011	Plutonium: 0.52 metric tons (4.2 metric tons, Strategic) HEU: 2.0 MT	Plutonium: 0.14 metric tons HEU: 2.7 metric tons
2013	Plutonium: 0.54 metric tons (4.7 metric tons, Strategic) (0.24 metric tons, Civilian) HEU: 2.4 metric tons	Plutonium: 0.15 metric tons HEU: 3 MT ($\pm$ 1.2)
2015	Plutonium: 0.59 metric tons (3.4 metric tons, Strategic) (0.2 metric tons, Civilian) HEU: 3.2 metric tons	Plutonium: 0.17 metric tons HEU: 3.1 metric tons

A Realistic Appraisal of Pakistan's Prospective Nuclear Force Structure in 2025:

No official figures for Pakistan's fissile material stockpiles or weapons inventory have ever been released by the government of Pakistan, and no authentic information is available in the public domain about the size and capacity of Pakistan's fissile material production plants. Despite the paucity of information, a reasonable estimate can be created from data that exists, once important considerations, such as the economic and industrial capacity, availability of requisite raw materials, doctrine, posture, and politico-diplomatic and strategic compulsions, are accounted for.

Hans M. Kristensen and Robert S. Norris, in their latest report for the *Bulletin of Atomic Scientists*, estimate the Pakistani nuclear stockpile at between 110 and130 warheads, whereas the Arms Control Association's fact sheet estimates 110 warheads. The median figure is 120 warheads. Pakistan's capacity to produce HEU-based warheads is usually estimated to be about four weapons per year and, therefore, it could produce around 40 additional HEU-based warheads over the next decade. Currently, Pakistan has four operational plutonium production reactors at its Khushab complex. Assuming the reactors run at 60 percent capacity, each would produce slightly less than two weapons' worth of plutonium per year, toward a total output of around 36 kilograms of plutonium—six warheads at 6 kilograms per warhead—per year. This suggests that Pakistan could produce up to 60 plutonium warheads over the next decade. The gross total of warheads by 2025, both plutonium- and HEU-based, should be 220, based on available unofficial estimates: 120 warheads in

the current arsenal, plus 100 additional warheads. Kristensen and Norris have likewise estimated the size of Pakistan's arsenal in 2025 to be between 220 and 250 warheads.

Arriving at these figures entails making a number of assumptions about the number and capacity of Pakistan's centrifuges; the efficiency of Pakistani plutonium production reactors; their uninterrupted operation throughout the year; the amount of HEU and plutonium needed for each warhead; Pakistan's requirements for naval propulsion; whether Pakistan has been and will continue to convert all of the available material into warheads or maintain some reserve of fissile materials outside warheads; whether Pakistan has determined an upper figure for the size of its arsenal; and Pakistan's capacity to produce and stockpile requisite delivery systems for all these warheads. Finally, these estimates all assume that Pakistan will continue to produce fissile materials until 2025, rather than ceasing production somewhere in the near future, having satisfied its operational needs.

Pakistan's nuclear forces in 2025 will have a wide variety of delivery systems for full spectrum deterrence but will in all probability, comprise fewer than 200 warheads made from both HEU and plutonium, with a wide range of yields, all the way from low-yield to (potentially) boosted fission devices. Pakistan's delivery systems will likely be a mix of solid-fueled surface-to-surface ballistic missiles with short and medium ranges, ground- and air-launched cruise missiles—some of which may be deployed on surface naval vessels and submarines—gravity bombs delivered by appropriate aerial platforms, and maybe indigenously developed nuclear-powered submarines. Pakistan likely will not keep

building its nuclear arsenal for an indefinite period, given its economic constraints and comparatively modest nuclear force requirements—its deterrence is focused on India and is not meant to seek regional or global power status. The availability of delivery systems might also be a limiting factor for the size of Pakistan's nuclear arsenal.

Beginning in 2010, Pakistan has carried out the Azm-i-Nau (New Resolve) series of military exercises to test changes made to meet the challenge posed by India's Cold Start doctrine. These exercises have proved that Pakistan could effectively counter Cold Start–type operations with conventional forces. However, as the gap between Indian and Pakistani conventional forces continues to widen in India's favor, and as Pakistan remains engaged in prolonged counterterrorism operations in various parts of the country, the Pakistan Army's conventional response to Cold Start may not be sufficient in the future. Introducing a short-range battlefield nuclear weapon system like the Nasr provides reassurance in case conventional deterrence fails or India embarks on an adventurist policy, as suggested by some Indian cabinet ministers in the aftermath of an Indian special-forces operation in Myanmar. Weapons like the Nasr have enhanced Pakistan's options and complicated Indian calculations for conventional military incursions into Pakistan. Indian planners cannot ignore battlefield nuclear weapons, despite the dismissive attitude displayed by the former chairman of India's National Security Advisory Board Shyam Saran and other Indian security analysts. Pakistan's nuclear forces will maintain their present configuration to cover the whole spectrum of threats with a variety of nuclear warheads and delivery systems in the foreseeable future, barring

drastic changes in the overall security environment or a major improvement in India-Pakistan relations.

CONCLUSION

Pakistan's nuclear arsenal will grow in the short term, but that growth will not be unbridled and will certainly be far less than suggested in some recent studies.[27] Pakistan will likely maintain its current inventory of solid fueled missiles: the Ghaznavi (Hatf-III), various versions of the Shaheen-1 (Hatf-V), the Shaheen-2 (Hatf-VI), the cruise missile Babur (Hatf-VII), the air-delivered cruise missile Raad (Hatf-VIII), and the Shaheen-3 (Hatf-X), plus short-range missiles like the Nasr (Hatf-IX) and some improved version of the Abdali (Hatf-II). It is possible that the liquid-fueled Ghauri (Hatf-IV) will be retired from service by 2025.

Contrary to the specter that full spectrum deterrence—an unfamiliar term in nuclear jargon—necessitates a very large arsenal, Pakistan's full spectrum deterrence arsenal will be modest in size, albeit with a wide variety of delivery systems, including short- and medium-range ballistic missiles, cruise missiles, and aircraft delivery systems. One can also not rule out the possibility of a significant improvement in India-Pakistan relations, which would mitigate the incentives and pressures for Pakistan to build and maintain a larger arsenal.

Notes

*This chapter is based on a similar paper published as part of a publication entitled 'Regional Voices on the Challenges of Nuclear Deterrence Stability in Southern Asia', by Carnegie Endowment for International Peace and is being published with special permission by the editor of the Carnegie Study.

[1]Hassan Khan, "Pakistan Has Fastest Growing Nuclear Weapons Programme in the World: Report," *Express Tribune*, November 24, 2014.

[2]Tim Craig, "Report: Pakistan's Nuclear Arsenal Could Become the World's Third-Biggest," *Washington Post*, August 27, 2015.

[3]Rishi Iyengar, "Pakistan Will be World's Fifth Largest Nuclear Power by 2025," *Times*,October 22, 2015. Hans Kristensen and Robert Norris also estimate that Pakistan's arsenal would be the fifth largest in the world by 2025, see Hans M. Kristensen and Robert S. Norris, "Pakistani Nuclear Forces, 2015," *Bulletin of the Atomic Scientists* 71, no. 6 (November 2015): 59–66.

[4]Based on the timing of the publication of the article, Michael Krepon has argued that it was in response to India's Draft Nuclear Doctrine. See Michael Krepon, *Pakistan's Nuclear Strategy and Deterrence Stability* (Washington, DC: Stimson Center, 2012), 8, http://www.stimson.org/images/uploads/research-pdfs/Krepon_-_Pakistan_Nuclear_Strategy_and_Deterrence_Stability.pdf.

[5]Agha Shahi, Zulfiqar Khan, and Abdul Sattar, "Securing Nuclear Peace," *The News International*, October 5, 1999.

[6]Ibid.

[7]Jaswant Singh stated that, "Minimum deterrence is not quantification. It is not a fixity. It is the enunciation of a fixity. The principle is codified in cold war phraseology. It is to be determined in accordance with the reality of an assessment of the security situation. And as the security situation alters with time determination of minimum deterrence also alters." "An Interview with Shri Jaswant Singh, Minister for External Affairs," India Today, January 11, 1999.

[8]Rodney W. Jones, *Minimum Nuclear Deterrence Postures in South Asia: An Overview*, (Washington, DC: Defense Threat Reduction Agency, Advanced Systems and Concepts Office, October 1, 2001), 3.

[9]"1998 Nuclear Tests Gave Parity to Pakistan: Jaswant Singh," *Press Trust of India*, November 28, 2010, http://www.dnaindia.com/india/report_1998-

nuclear-tests-gave-parity-to-pakistan-jaswant-singh_1473590-all

[10]Maleeha Lodhi, "Pakistan's Nuclear Compulsions," *The News International,* November 6, 2012.

[11]Ibid.

[12]Ibid.

[13]Paulo Cotta Ramusino and Maurizio Martellini, *Nuclear Safety, Nuclear Stability and Nuclear Strategy in Pakistan: A Concise Report of a Visit By Landau Network – Centro Volta*, (Como, Italy: Landau Network – Centro Volta, January 2002).

[14]"No. PR94/2011-ISPR," press release, Inter Services Public Relations, April 19, 2011, http://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=1721.

[15]Rodney W. Jones, "Pakistan's Answer to Cold Start?," Friday Times, May 13, 2011; Mansoor Ahmed, "Why Pakistan Needs Tactical Nuclear Weapons," *Weekly Pulse*, May 6, 2011.

[16]Feroz Khan, *Eating Grass: The Making of the Pakistani Bomb* (Stanford, CA: Stanford University Press, 2012), 396.

[17]For a balanced view, see Jones, "Pakistan's Answer to Cold Start?"; for a critical view, see Ejaz Haider, "Stupidity Goes Nuclear," *Express Tribune*, April 26, 2011.

[18]Khalid Kidwai, "A Conversation with Gen. Khalid Kidwai" (interview at Carnegie International Nuclear Policy Conference, Carnegie Endowment for International Peace, Washington, DC, March 23, 2015), http://carnegieendowment.org/files/03-230315carnegieKIDWAI.pdf.

[19]Ibid.

[20]Michael Quinlan, *Thinking About Nuclear Weapons – Principles, Problems, Prospects* (Oxford: Oxford University Press, 2009), 36.

[21]The US strategy evolved from Massive Retaliation to Flexible Response to Assured Destruction to Limited Nuclear Options to Countervailing and then to the Prevailing Strategy partly due to changing security environment and partly due to technological advancements.

[22]Kidwai, "A Conversation with Gen. Khalid Kidwai."

[23]The United States has, for instance, reduced the number of its operational

nuclear warheads to 1,900 but continues to undertake qualitative upgrades for these warheads. See "Fact Sheets & Briefs: U.S. Nuclear Modernization Programs," *Arms Control Association*, January 16, 2014, https://www.armscontrol.org/factsheets/USNuclearModernization; and Eugene Miasnikov, Matthew Kroenig, and Lu Yin, "Modernizing Nuclear Arsenals: Whether and How," *Bulletin of the Atomic Scientists*, 2015, http://thebulletin.org/modernizing-nuclear-arsenals-whether-and-how7881 for details of the ongoing and planned modernization programs in the United States and the Russian Federation.

[24]GFMR 2013 acknowledges this fact stating that, "Estimates are limited by the uncertainty about Pakistan's enrichment capacity, and the operating history of its centrifuge plant at Kahuta and possibly a second plant that reportedly exists at Gadwal." International Panel on Fissile Materials, Global Fissile Materials Report 2013: *Increasing Transparency of Nuclear Warhead and Fissile Material Stocks as a Step toward Disarmament* (Princeton, NJ: International Panel on Fissile Materials, 2013), 14.

[25]Hans M. Kristensen and Robert S. Norris have suggested that, "Speculation that Pakistan may become the world's third largest nuclear weapon state – with a stockpile of some 350 warheads a decade from now – are, we believe, exaggerated because that would require a buildup of two to three times faster than growth over the past two decades. Pakistan simply doesn't have the industrial capacity to develop, produce and deploy that many additional nuclear weapon systems in a decade." See Kristensen and Norris, "Pakistani Nuclear Forces, 2015."

[26]Ibid.

[27]See for instance, Toby Dalton and Michael Krepon, *A Normal Nuclear Pakistan* (Washington, DC: Stimson Center and Carnegie Endowment for International Peace, 2015).

CHAPTER: 9

CONTEMPORARY NUCLEAR DEBATES

Zafar Nawaz Jaspal

In the parlance of International Relations theorists, the Contemporary Nuclear Debates are dominated by the realists' worldview. The neo-realists or structural realists' perspective that 'proliferation begets proliferation' appears to be the basis of both current vertical proliferation and probability of horizontal proliferation in the future.[1] The gradual shrinking of the arms control constituency since the cessation of Anti-Ballistic Missile Treaty in June 2002, increasing incompetence of the nuclear non-proliferation regime and a prolonged deadlock at the Conference on Disarmament at Geneva oblige the nuclear weapons states to contemplate and modernize their nuclear arsenals by refurbishing their nuclear weapons delivery vehicles and also revising/ revamping their nuclear postures.

The review of current literature on the subject reveals three important issues in the nuclear debate. First, the commencing of a new era of global nuclear force modernization and growth and rethinking on no first use of nuclear weapons; Second, "the international nuclear non-proliferation regime is under severe stress as a consequence of serious proliferation breaches and disarmament efforts failure."[2] Additionally, the political, economic and strategic priorities of the United States and its' like-minded states have serious ramifications for the nuclear non-proliferation regime. Third, there is likelihood of nuclear and radiological terrorism. Indeed, these issues directly influence the South Asian strategic environment.

The nuclearization of South Asia appears to have created a cold peace between India and Pakistan. The contemporary nuclear debates, however, reflect alarms about the unending nuclear arms race between India and Pakistan. The nuclear arms race certainly impacts the strategic instability in South Asia. Ironically, the debate instead of focusing on both India and Pakistan's nuclear arsenals modernization only concentrates on the transformation in Pakistan's nuclear posture. Many analysts consider Pakistan's nuclear arsenal risky for the international security and thereby directly and indirectly continually pressurizes Islamabad to revamp its nuclear policy.[3] Despite, the opposition, Islamabad has been modernizing its nuclear weapons arsenal. On September 5, 2013, Pakistan's National Command Authority announced that the country acquired 'Credible Minimum Full Spectrum Nuclear Deterrence' ability and capability.[4] Many analysts recognize the rationale of Islamabad's full spectrum nuclear posture. They acknowledge that its neighborhood poses extreme difficulties for

it, and staying immune from the anarchic developments in the Indian held Kashmir was hard. Without the nuclear weapons capability, Islamabad cannot defend its eastern flank.

This chapter is structured into four sections. The first section includes discussion on nuclear force modernization. The second section deliberates on the nuclear non-proliferation regime. Third section includes discussion on nuclear/radiological terrorism. It is followed by discussion on the nuclear weapons implications on the South Asian strategic environment.

Nuclear Force Modernization

The strategic pundits are debating the negativity of the aging process of nuclear arsenals. Review of the nuclear doctrines of the nuclear-armed states reveals the commencement of a new era of nuclear force modernization and growth. The nuclear weapons states are verging on another nuclear arms race. It's because;

> Nuclear powers feel the need to modernize their arsenals for three main reasons. First, in today's international security environment they still see nuclear weapons as necessary, mainly for deterrence purposes. Second, nuclear weapons continue to play a very important role in maintaining global strategic stability. Third, as long as nuclear arsenals exist, modernization is necessary in order to keep weapons safe and reliable.[5]

The review of literature reveals that currently the long-term nuclear force modernization or advancement programs are underway in all the nuclear-armed states.[6] According to the SIPRI Yearbook 2015, "all the nuclear weapon-possessing states are working to develop

new nuclear weapon systems and/or upgrade their existing ones."[7] The United States has planned to spend $355 billion to modernize its nuclear arsenal 2014 and 2023.[8] Moscow had also disclosed similar plan to refurbish its nuclear arsenal. Russian Federation announced to add more than 40 intercontinental ballistic missiles (ICBM) to its nuclear arsenal during 2015.[9] In addition to strategic weapons modernization, Moscow is also brandishing its tactical nuclear weapons capability. Similarly, British government announced "to spend £100bn-plus on a new fleet of four Trident nuclear ballistic submarines to provide a Continuous At Sea Deterrence."[10] India's nuclear posture is also entering in an important new phase with the development of several long-range ballistic missiles, nuclear-powered ballistic missile submarine and increase in weapon grade fissile material.[11] Similarly, Pakistan continues to expand its nuclear arsenal "With several delivery systems in development, four operating plutonium production reactors, and its uranium facilities". Pakistan's stockpile will likely continue to increase over the next 10 years."[12]

The United States, Israel and India have been investing in the missile defense systems. They vetoed Prevention of Arms Race in Outer Space Treaty (PAROS) in 2005. Since then, PAROS lost support at the Conference on Disarmament, Geneva. On May 1, 2001, Washington had promised that it would assist its allies in the development of their Ballistic Missile Defense programs.[13] The confidence in the Missile Defense Systems' operational technologies definitely obliges the nuclear-armed states to increase the quantity of their weapons as well as adopt advanced techniques to defy the missile defense shield.

The Russians have been taking the United States and NATO Missile Defense Systems buildup very seriously. Therefore, they have been engaged in countermeasures. They adopted both diplomatic censure and technological methodologies to mitigate the effect of the deployment of the Missile Shield components in Romania, Poland and Czech Republic. Moscow has been advancing its Yu-74 ultra-maneuverable hypersonic glide vehicles to penetrate or defy the NATO'S missile defense installations in Eastern Europe.

> A hypersonic weapon usually has a speed between 3,840 miles per hour (Mach 5) and 7,680 miles per hour (Mach 10). Furthermore, these systems use sophisticated technologies for maneuvering and boast allow the rapid delivery of warheads, precise targeting and survivability against wide range of missile defense systems.[14]

Moreover, Russians seem nervous about the expanding membership of NATO and its deployment of missile defense systems in its former satellite Eastern European states. One of Moscow's strongest incentives to violate—or even abrogate—the Intermediate-range Nuclear Forces Treaty (restricting land-based intermediate-range missiles) was to deploy nuclear capable missiles in Kaliningrad.

Nuclear Non-Proliferation Regime

The idealists or nuclear abolitionists had succeeded in institutionalizing the nuclear non-proliferation regime during the second half of the twenty-century. Interestingly, the non-proliferation regime instead of initiating a process of nuclear disarmament; has ended up in serving the military interests of the great powers in the global politics. The international nuclear

non-proliferation regime has only been successful in limiting the horizontal proliferation of nuclear weapons. Nuclear disarmament remains a wishful objective and nuclear weapon states have been progressively modernizing their nuclear arsenals.

The contemporary nuclear debate underscores the discriminatory nature of nuclear non-proliferation regime that has permanently created the split of states into two blocs — the nuclear weapon states and non-nuclear weapon states. The nuclear weapon states (NWS)—the United States, the Russian Federation, Britain, France and China—are permitted to maintain and modernize their nuclear weapons arsenals. Simultaneously, it is illegitimate for non-nuclear weapon states (NNWS) to possess nuclear weapons for their national security. Importantly, the nuclear non-proliferation regime receives immense rhetorical support from nuclear weapon states. In reality, the regime is victim of the great power politics.

The contemporary nuclear debate manifests that the new strategic partnerships and increasing connectivity in the 21st century make many non-proliferation regimes arrangements vulnerable to the political, economic and strategic agenda of the great powers. For instance, the significance of India in the strategic calculations of the United States negatively influenced the nuclear non-proliferation regime. The Nuclear Suppliers Group (NSG) is one of the important components of nuclear non-proliferation regime. The NSG members ensure comprehensive safeguards of the International Atomic Energy Agency (IAEA) on the nuclear facilities of the recipient non-nuclear weapon state prior to the transferring of the nuclear technology and materials. So that the

recipient non-nuclear weapon state should not be able to exploit the dual-use feature of the nuclear technology for developing nuclear weapons.

India's geo-strategic significance in United States strategic calculation resulted in Indo-US civil nuclear cooperation in 2005. This cooperation certainly has positive contribution in the Indian nuclear industry. Conversely, it severely undermined the credibility of the NSG. NSG's credibility dented when its members made an amendment in the trade laws of the Group and granted a special waiver to India in 2008.[15] In simple terms, they accepted a state-specific amendment instead of adopting norms based equitable non-discriminatory criterion. The NSG members accommodated India to benefit from its growing economic market. Indeed, the granting of an exceptional waiver to India under the American influence and for the short-term economic and geopolitical interests by the members of NSG was in conflict with the objectives of the cartel. "This trade waiver has allowed New Delhi to vertically proliferate and destabilize the region."[16] The selective approach to accommodate India has severely undermined the credibility of the non-proliferation regime as well as has germinated pessimism about the future of the regime.

Today, many states have acquired skills to manufacture and export nuclear material. Mark Hibbs wrote that: "One NSG member state estimated in 2011 that 110 countries—more than half of them outside the NSG—can supply NSG-listed dual-use items."[17] The increasing number of the states having capability to supply dual items did not attract much attention because all these states, except Israel, India and Pakistan, are parties to the NPT.

India and Pakistan's bid to join the NSG in May 2016 germinated serious debate on the expansion of the NSG. The objective of the debate is to find out a consensual method to increase the membership of the cartel. Nevertheless, chalking out a consensual mode seems a cumbersome process due to the trends in the global politics and distinct characteristics of the new aspirants, i.e. India and Pakistan. The debate continues to direct efforts to find a balance in balancing between the political necessities and norms based equitable non-discriminatory criteria. In addition, the contemporary debate is also concentrating on two contrasting subjects, i.e. keeping India and Pakistan out of the Group due to their disagreeing to join the NPT as a non-nuclear weapon state would undermine the NSG's objectives. The competing argument is that granting India and Pakistan full membership of the NSG would affect the credibility of the cartel. The proponents of New Delhi have been insisting that the 2008 NSG waiver is enough to establish India's right to be a member of the club. Conversely, many analysts have been recommending the criteria-based rule.[18] Michael Krepon argued: "India advocated a merit-based approach, but this begged the question of how to measure merit. Standards are needed to assess merit, whether they are called criteria or not."[19]

The 2015 Nuclear Non-Proliferation Treaty review conference (27 April to 22 May 2015) exposed the imperfections of the Treaty and the divisions among key parties instead of their collective efforts to help to advance the disarmament cause.[20] The review conference ended without an agreement on a final document. The preceding discussion reveals that currently nuclear weapon states have been pursuing their nuclear arsenals related objectives with vigor

and firmness. They intelligently twist non-proliferation regime's censuring clauses or preventive arrangements to their advantage without realizing that these acts would put the regime in tatter.[21] Consequently, the core items of Conference on Disarmament—Nuclear disarmament; A treaty banning the production of fissile material for nuclear weapons and other nuclear explosive devices; The prevention of an arms race to outer space; and Negative security assurances—have failed to receive an affirmative response from the members of Conference on Disarmament.[22]

Nuclear/Radiological Terrorism

The security analysts have been debating the probability of the threat of nuclear terrorism since the beginning of the twenty-first century. In theory, the nuclear terrorism seems easy to carry out. However, the careful study of nuclear material acquisition and steps involved in manufacturing and exploding nuclear device manifest that nuclear terrorism is a cumbersome task. It becomes more difficult, if the terrorist organization somehow manages to get hold of a nuclear weapon and tries to use it, due to the inbuilt device code systems. Nonetheless, it would be an equally illogical conclusion that nuclear terrorism is a myth rather than reality. Though we have no precedent of nuclear terrorism, yet its possibility does not cease to exist.

The discourse on the nuclear technology underscores that the engineering of fissile material such as plutonium or highly enriched uranium is beyond the capability of any non-state actor, including al-Qaeda or Daesh led terrorist syndicates. The incapability of terrorist organization to engineer fissile material

does not eliminate completely the chances of nuclear terrorism. President Barack Obama stated on April 5, 2009: "Black market trade in nuclear secrets and nuclear materials abound. The technology to build a bomb has spread. Terrorists are determined to buy, build or steal one. Our efforts to contain these dangers are centered on a global non-proliferation regime, but as more people and nations break the rules, we could reach the point where the center cannot hold."[23] He added: "One terrorist with one nuclear weapon could unleash massive destruction. Al Qaeda has said it seeks a bomb and that it would have no problem with using it. And we know that there is unsecured nuclear material across the globe."[24]

The alarming reality is that the dual-use nuclear materials, technologies and know-how are widely traded in the international market under the pretext of peaceful application in the medical, agriculture and power-generation sectors. Small quantities of both fissile materials and highly radioactive materials, sufficient to manufacture a radiological dispersal device, are also available in the global black market.[25] It was reported that there is enough nuclear material spread around the globe to build more than 120,000 Hiroshima-sized nuclear bombs.[26] A few storage sites nuclear/radiological materials are inadequately secured and such sites continue to be added in unstable regions.[27] Attempts for stealing fissile material were also reported.[28] Nonetheless, weak security apparatus and nuclear non-proliferation regimes inability to prevent the illicit nuclear trade is to the benefit of transnational terrorist groups that are determined to use nuclear/radiological terrorism to accomplish their perilous designs.

Analysts have consensus that the nuclear facilities designed for peaceful use of nuclear technology are poorly secured and guarded. Therefore, there is a possibility that terrorists could steal nuclear material from these nuclear facilities for their nefarious objectives.[29] Kofi Annan stated in 2005: "Nuclear terrorism is still often treated as science fiction. I wish it were. But unfortunately we live in a world of excess hazardous materials and abundant technological know-how, in which some terrorists clearly state their intention to inflict catastrophic casualties."[30] Graham Allison also expressed similar view that: "Is nuclear mega-terrorism inevitable? Harvard professors are not known for being subtle or ambiguous, but I'll try to the clear. Is the worst yet to come? My answer: Bet on it. Yes."[31] It was reported that terrorist organizations contacted the scientists for the information. Kenneth N. Luongo and Brig. Gen. (Ret.) Naeem Salik pointed out:

> Two physicists from Pakistan with knowledge of the nuclear program, retired Pakistan Atomic Energy Commission (PAEC) scientists Sultan Bashiruddin Mahmood and Abdul Majid, have admitted to speaking with Bin Laden, although they denied that any sensitive information was divulged.[32]

However, the fact remains that the terrorist organization did contact the physicists. The preceding discussion shows that nuclear and radiological terrorism is not a theoretical risk. That the terrorist groups may cause nuclear havoc is a realistic threat. During the last week of March 2016, Belgian media reported alarming news that: "Two of the Brussels suicide bombers secretly filmed the daily routine of the head of Belgium's nuclear research and development program and considered an attack on a nuclear site in the country." On March 30, 2016, President Barack Obama

wrote in an opinion piece in The Washington Post:

> Of all the threats to global security and peace, the most dangerous is the proliferation and potential use of nuclear weapons. That's why, seven years ago in Prague, I committed the United States to stopping the spread of nuclear weapons and to seeking a world without them.[33]

He added:

> Given the continued threat posed by organizations such as the terrorist group we call ISIL, or ISIS, we'll also join allies and partners in reviewing our counterterrorism efforts, to prevent the world's most dangerous networks from obtaining the world's most dangerous weapons.[34]

President Obama's zealous campaign against the nuclear terrorism resulted in the organization of four Nuclear Security Summits. The fourth and final Nuclear Security Summit held in Washington D.C. on March 31 and April 1, 2016 reiterated the probability of nuclear terrorism. Nuclear Security Summit 2016 Communiqué stated: "The threat of nuclear and radiological terrorism remains one of the greatest challenges to international security, and the threat is constantly evolving." Nevertheless, the Summit process resulted in the establishment of a nuclear security regime, i.e. patchwork of many treaty commitments, bilateral and multilateral initiatives, and informal rules. For instance: the summit process created an action plan for nuclear security under the auspices of five international organizations: the IAEA, the United Nations, Interpol, the Global Initiative to Combat Nuclear Terrorism, and the Global Partnership Against the Spread of Weapons and

Materials of Mass Destruction. In this context, the primary role was assigned to IAEA. According to the Nuclear Security Summit 2016 Communiqué:

> We reaffirm the essential responsibility and the central role of the International Atomic Energy Agency in strengthening the global nuclear security architecture and in developing international guidance, and its leading role in facilitating and coordinating nuclear security activities among international organizations and initiatives and supporting the efforts of states to fulfill their nuclear security responsibilities.[35]

More precisely, the threat of nuclear/radiological terrorism is not viewed as an apocryphal in the national security policy formulations.

Implications for South Asia

The Nuclear Deterrence Stability guaranteeing strategic stability theory was evolved during the Cold War period. The contemporary nuclear analysts have seriously been deliberating on the functionalism of Nuclear Deterrence Stability notion in South Asia, where India and Pakistan maintain advanced nuclear weapons and having destabilizing confrontational relationship. The alarming variable is that technologically, both India and Pakistan nuclear arsenals are becoming more sophisticated and capable—and so too are having conventional precision-strike options. Importantly, Islamabad's reliance on nuclear weapons to offset New Delhi's growing conventional arsenal has gradually been increasing due to formal's financial constraints to purchase sophisticated conventional military hardware. The trends reveal

that Pakistani nuclear weapons would remain a force for peace because these weapons induce a degree of caution in the Indian military decision-makers.

Nuclear optimists are confident that nuclear weapons of India and Pakistan sustain the strategic stability in the region. In the words of Waltz: "Stability in the continent now exists; it had not existed since World War II and the partition of India and Pakistan. Now with nuclear weapons on both sides, India and Pakistan can no longer fight even a conventional war over Kashmir."[36] Rod Lyon also pointed out, "Even in the South Asian case—the world's only case where two regional nuclear-armed enduring rivals confront one another—decades have now passed without a crossing of the nuclear threshold."[37]

Waltz' and Lyon's optimism about the sustainability of strategic stability between India and Pakistan, however, came under stress at a few occasions. The limited war between India and Pakistan in summer 1999 (Kargil Conflict) and ten-month-long eyeball-to-eyeball military deployments on the common border in 2001-2002 generated confidence in the nuclear deterrence stability. These conflicts, however, reinforced the vitality of strategic stability-instability paradox between India and Pakistan.

The alarming development during the last decade is that the immense Indian armed forces modernization and financial constraints of Pakistan to upgrade its conventional arsenal due to the 'war on terrorism' have driven both Indian strategic community and ruling elite into a 'strategic supremacy obsession' in South Asia. Therefore, New Delhi is endeavoring to acquire

a military capability to launch a swift limited war to punish Pakistani armed forces without crossing the nuclear threshold. The Cold Start Doctrine declassified in April 2004,[38] and later the announcement of Proactive Military Operation Strategy in 2010 alarmed about the confidence of the Indian strategic community to pursue successfully the political objectives through military means (limited-war) against the nuclear capable Pakistan.

India's flirting with limited war concept has raised alarm about the inadvertent escalation of the conflict entailing nuclear exchanges between the two nuclear-armed adversaries. In December 2015, former US Defense Secretary William Perry listed in the possibility of a regional nuclear war on the subcontinent as one of his five 'nightmare scenarios'. He wrote,

> During the 2008 terrorist attacks on Mumbai, India showed restraint by not countering with an attack. If there is ever a second Mumbai-type attack, I fear that India would not show restraint again: India could respond with a military incursion, prompting Pakistan to respond with tactical nuclear weapons. This is in turn would provoke India to respond in kind, and a regional nuclear war would be underway.[39]

The critical examination of Pakistani nuclear posture reveals that if India attacks Pakistan, the latter check former military adventurism with its vibrant military muscle. Therefore, many analysts believe that India-Pakistan "rivalry offers a live conduit to a nuclear exchange."[40]

The countermeasures of Islamabad, such as, conduct of series of Azm-i-Nau military exercises and modernization of nuclear

muscle, especially development of tactical weapons have a frustrating impact on New Delhi. Consequently, the latter intensified its 'bait and bloodletting' strategy against Pakistan. In this context, India announced its accomplishments in the ballistic missile defenses and indirectly forced Pakistan to increase qualitatively and quantitatively its ballistic missiles inventories. This is because ballistic missile defenses work best against shorter-range missiles, fired in small numbers and deploying only simple or no countermeasures. Once any of those three factors changes, interception becomes harder. If all three change, effective defense becomes impossible.[41]

Hence, presently, it seems imperative for Islamabad to develop longer-range missiles with sophisticated capabilities and also increase the number of its ballistic missiles to defy Indian missile defenses. Indeed, Islamabad can manage or dodge Indian ballistic missile interceptors. Of more concern is the surveillance assets deployed as part of the missile defense units, in particular radars. Islamabad fears that such radars provide advanced early tracking data to the Indian air force and air defenses.

The action-reaction syndrome between India and Pakistan, certainly, contains the germs of instability. In April 2016, President Barack Obama stated that,

> We're concerned by the increased security challenges that accompany growing stockpiles, particularly tactical nuclear weapons that are designed for use on the battlefield. And these systems are a source of concern because they're susceptible to theft due to their size and mode of employment. Essentially, by having these smaller weapons,

> the threshold for their use is lowered, and the [re is] risk that a conventional conflict between India and Pakistan could escalate to include the use of nuclear weapons.[42]

Moreover, the nuclear analysts seem inconclusive about New Delhi and Islamabad's ability to manage their crises without the intervention of Washington.

India and Pakistan have been lobbying for membership of the Nuclear Suppliers Group. Therefore, both Islamabad and New Delhi have been following the norms of the nuclear non-proliferation regime as well as expressing their serious commitment with the United Nations Security Council Resolution 1540. Despite it, many analysts deliberate about their ruling elite's behavior whether they are acting responsibly. The general understanding in the nuclear discourse is that responsible ruling elite always refrains from warmongering and provoking tactics in a nuclearized strategic environment. Conversely, the reckless leadership approves coercive diplomacy to blackmail or coerce a nuclear capable adversary. The former realizes the perilous repercussions of the war between the nuclear weapons states. Whereas; the latter fails to envision the lethality of a conflict escalation between the nuclear armed states. Indeed, such a reckless behavior of the ruling elite qualifies that state to be referred to as 'an irresponsible nuclear weapon state'.

The Indian hawks have expressed their desire to conduct surgical strikes or hot pursuit against nuclear-armed Pakistan. This attitude of the Indian hawks manifest that they are convinced about the possibility of a limited conventional war remaining limited between the nuclear-armed strategic competitors. Indeed,

the limited conventional war between the nuclear weapon states is possible with a probability of its escalation into all-out war including the nuclear strikes exchanges. The situation becomes more dreadful if the conventional asymmetry exists between the nuclear capable adversaries. The conventionally weaker state relies on its nuclear weapon capability to deter the aggression of the conventionally superior adversary. Precisely, the perception of the Indian strategic pundits that India would bleed Pakistan in a limited war with immunity mirrors the poor understanding of the nuclearized strategic environment as well as their strategic insanity.

The civil-military relations in the polity of Pakistan remain an attractive factor in the contemporary nuclear debates. Since August 2014, the role of military in the national security policy formulation has increased. The increasing role of Chief of Army Staff in the realm of national security policy formulation and accomplishment has directly increased his influence in the foreign and strategic policy makeup and implementation. Though the configuration of the National Command Authority (NCA) features the primacy of civilian ruling elite in the nuclear decision-making, yet the current role of armed forces in the national security and the role traditionally military played, as a political force in domestic politics of Pakistan, breed perception about the relegation of political leadership role to military leadership in the nuclear decision-making processes.[43]

Generally, the military leadership is viewed as more risk-acceptant than the political or civilian leadership. Equally, one cannot miscalculate the ideologically driven political leadership's

attitude towards the crisis. It is equally prone to risk-acceptance in a crisis, especially, when it is ethno-centrically biased and militaristic in its approach to garner support of the masses. Prime Minister Narendra Modi stated in 2014 that: "This is not the time for empty boli'(talk) by them, but for goli (bullet) by our jawans."[44] On September 29, 2016, Indian DGMO Lt Gen Ranbir Singh announced in a joint press conference of the Indian Ministry of External Affairs and Ministry of Defense: "some terrorist teams had positioned themselves at launch-pads along the Line of Control. The Indian army conducted surgical strikes last night at these launch-pads. Significant casualties have been caused to these terrorists and those who are trying to support them." [45] The Premier Modi Government endorsed the DGMO claim. Certainly, it is a reflection of Indian both civilian and military leadership's irresponsible behavior. Conversely, Islamabad's response was very rational. On September 30, 2016, Prime Minister Nawaz Sharif stated that Pakistan's restraint should not be mistaken for weakness. The Pakistani leadership maintains that if there is a surgical strike on Pakistani soil, the same will be strongly responded. These elaborations manifest that, Premier Modi's continuous threatening statements may spiral out of control the prevalent tension between India and Pakistan.

CONCLUSION

The contemporary nuclear debates underscore that nuclear weapon states reliance on the nuclear weapons for their national security would not decrease in the near future. They, therefore, continue upgrading their respective nuclear arsenals. Simultaneously, the nuclear non-proliferation regime would only enjoy rhetorical

support from the nuclear weapon states. Moreover absence of tangible initiatives for denuclearization may encourage a few states to acquire or maintain a latent nuclear weapons capability. Perhaps, a latent nuclear power would cross the threshold and acquire indigenous nuclear arsenal in a transformed regional strategic environment.

The international security is a shared responsibility and thereby the global consensus is imperative for an effective enforceable system for securing nuclear materials to protect the world from dangers of nuclear and radiological terrorism. The participants rightly pronounced in Nuclear Security Summit 2016 Communiqué:

> Countering nuclear and radiological terrorism demands international cooperation, including sharing of information in accordance with States' national laws and procedures. International cooperation can contribute to a more inclusive, coordinated, sustainable, and robust global nuclear security architecture for the common benefit and security of all.

Hence, instead of "discriminatory approach" in the nuclear realm, "universal approach" should be adopted in engaging the sovereign nations to ensure the safety and security of nuclear material and facilities.

The Vertical proliferation of nuclear weapons manifests that any future war between India and Pakistan would always be with a nuclear backdrop. The contemporary nuclear debates indicate that war would be a lose-lose affair for both India and Pakistan. Nonetheless, the belligerent relationship coupled with warmongering sporadically sparks minor skirmishes at the Line

of Control without spiraling into a limited war or escalating into a total war. It may therefore be safe to surmise that the nuclear arsenals have limited the scope of border skirmishes or exploitation of each other's intra-state conflicts in the sub-continent.

Notes

[1]Natasha E. Bajema, "Beyond the Security Model: Assessing the Capacity of Neoclassical Realism for Forecasting Nuclear Proliferation," in in William C. Potter and GaukharMukhatzhanova, ed. *Forecasting Nuclear Proliferation in the 21st Century: The Role of theory,* Vol. 1 (Stanford: Stanford University Press, 2010), pp. 58-79.

[2]William C. Potter and Gaukhar Mukhatzhanova, "Forecasting Proliferation: The Role of Theory, an introduction," in William C. Potter and Gaukhar Mukhatzhanova, ed. p.1.

[3]Toby Dalton and Michael Krepon, *A Normal Nuclear Pakistan*, Report (Washington D.C: Stimson Center and Carnegie Endowment for International Peace, August 2015.

[4]Pakistan's National Command Authority announced that the country acquired 'Credible Minimum Full Spectrum Nuclear Deterrence' ability and capability in September 2015. "Press Release", *Inter Services Public Relations* (ISPR), No. PR133/2013-ISPR, Rawalpindi, September 5, 2013. http://www.ispr.gov.pk/front/main.asp?o=t-press_release&id=2361, accessed on October 13, 2013.

[5]Lu Yin, "How to approach nuclear modernization? A Chinese response," *Bulletin of the Atomic Scientists,* Vol. 71, Issue 3, May 2015, p. 8.

[6]Hans M. Kristensen and Robert S. Norris, "Chinese nuclear forces, 2015," *Bulletin of the Atomic Scientists,* June 2015. http://bos.sagepub.com/content/early/2015/06/17/0096340215591247.full, accessed on June 20, 2015. *BASIC Trident Commission Discussion Paper 1*, Published by British American Security Information Council (BASIC), November 2011.

[7]"Nuclear weapons states upgrade warheads despite disarmament," *The News International,* June 15, 2015. http://www.thenews.com.pk/article-188056-Nuclear-weapons-states-upgrade-warheads-despite-disarmament, accessed on June 15, 2015. See also "Nuclear force reductions and modernizations continue; peace operations increase - new Sipri Yearbook out now." http://www.sipri.org/media/pressreleases/2015/yb-june-2015. accessed on June 15, 2015. *International campaign to abolish nuclear weapons*, http://www.icanw.org/faqs-2/, accessed on June 3, 2015.

[8]"Reductions in US warheads envisioned under the New Strategic Arms Reduction Treaty (New START) will be offset by upgrades in the quality of the US arsenal." Lu Yin, "How to approach nuclear modernization? A Chinese response," *Bulletin of the Atomic Scientists,* Vol 71, Issue 3, May 2015, pp. 8-9. Matthew Kroenig, "How to approach nuclear modernization?: A US response" *Bulletin of the Atomic Scientists,* Vol. 71, Issue, 3. May 2015. http://thebulletin.org/2015/may/how-approach-nuclear-modernization-us-response8291, accessed on June 27, 2015.

[9]"Putin Says Russia Beefing Up Nuclear Arsenal, NATO Denounces 'Saber-Rattling,'" *The New York Times,* June 16, 2015. http://www.nytimes.com/reuters/2015/06/16/world/europe/16reuters-russia-nuclear-putin.html?ref=world&utm_source=Sailthru&utm_medium=email&utm_term=%2AMorning%20Brief&utm_campaign=New%20Campaign&_r=0, accessed on June 21, 2015.

[10]Richard Norton-Taylor, "70 years after Hiroshima, nuclear weapons threaten us all" *The Guardian,* July 23, 2015, http://www.theguardian.com/news/defence-and-security-blog/2015/jul/23/70-years-after-hiroshima-nuclear-weapons-threaten-us-all, accessed on July 24, 2015.

[11]"In addition to the Dhruva plutonium production reactor near Mumbai, India plans to construct a second reactor near Visakhapatnam, on the east coast. An unsafeguarded prototype fast breeder reactor is also under construction 650 kilometers (km) south at the Indira Gandhi Centre for Atomic Research (IGCAR) near Kalpakkam, which will significantly increase India's plutonium production capacity once it becomes operational." Hans M. Kristensen, Robert S. Norris, "Indian nuclear forces, 2015", *Bulletin of the Atomic Scientists*, Vol. 71, Issue 5, September 2015, p, 77,

[12]Hans M. Kristensen, Robert S. Norris, "Pakistani nuclear forces, 2015," *Bulletin of the Atomic Scientists,* October 2015, http://bos.sagepub.com/content/early/2015/10/06/0096340215611090.full.pdf+html, accessed on November 2, 2015.

[13]The US President George W. Bush address at the National Defence University, Washington on May 1, 2001. White House transcript. http://www.fas.org/nuke/control/abmt/news/010501bush.html, accessed on October 22, 2016.

[14]Designed to carry up to 24 nuclear-loaded Yu-74 gliders, each Sarmat ballistic missile will be able to hit any target located within a 6.2 thousand mile radius in one hour. "Russian Top Secret Hypersonic Glider Can Penetrate Any Missile Defense," *Sputnik News,* June 11, 2016, http://sputniknews.com/politics/20160611/1041185729/russia-hypersonic-glider.html#ixzz4BavUpJbJ, accessed on June 15, 2016.

[15]It was reported that 'during the first NSG meeting on August 21-22, 2008, was inconclusive, with China leading countries with reservations - primarily Austria, Switzerland, Norway, Ireland and New Zealand. A fortnight later, following direct intervention by President Bush, China relented and the NSG ended sanctions on September 6, 2008.'

[16]Waseem Qutab, "What India's NSG application does not say?" *The News International,* July 20, 2016. https://www.thenews.com.pk/print/136214-What-Indias-NSG-application-does-not-say, accessed on July 20, 2016.

[17]Mark Hibbs, "Toward a Nuclear Suppliers Group Policy for States Not Party to the NPT," *Carnegie Nuclear Endowment for International Peace*, February 12, 2016. http://carnegieendowment.org/files/2-3-16_Hibbs_NSG_final_CTG.pdf, accessed on July 15, 2016.

[18]Twelve members of the Nuclear Supplier Group including China, New Zealand, Turkey, South Africa, Austria, etc. opposed the US move to include India in the 48-nation NSG during the June 2016 meeting of the Group at Seoul, South Korea.

[19]Michael Krepon, "Club Membership," *Arms Control Wonk*, June 26, 2016. http://www.armscontrolwonk.com/archive/1201515/club-membership/ accessed on June 28, 2016.

[20]Statement by Daryl G. Kimball to the 25th UN Conference on Disarmament Issues, Hiroshima, Japan, August 27, 2015. http://www.armscontrol.org/events/Statement-to-the-25th-UN-Conference-on-Disarmament-Issues, accessed on November 2, 2015.

[21]Zafar Nawaz Jaspal, "Emerging Nuclear Powers and International Non-Proliferation Regime," *CISS Insight,* Vol. 1, No. 4, August –September, 2013, pp. 1-18.

[22]The Conference on Disarmament (CD) in Geneva, Switzerland is the world's only permanent multilateral disarmament treaty negotiating body.

[23]"Remarks by President Barack Obama," Hradčany Square, Prague, Czech Republic, April 5, 2009. Office of the Press Secretary, The White House. http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/. Accessed on July 26, 2009.

[24]"Remarks by President Barack Obama," Hradčany Square, Prague, Czech Republic, April 5, 2009. Office of the Press Secretary, The White House. http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/. Accessed on July 26, 2009.

[25]Kevin O'Neill, "The Nuclear Terrorist Threat," Institute for Science and International Security, August 1997, p. 1. http://isis-online.org/uploads/isis-reports/documents/threat.pdf. Accessed on May 28, 2010.

[26]Fissile Material Working Group, "This is the year for nuclear material security," *Bulletin of the Atomic Scientists,* April 1, 2010. http://www.thebulletin.org/web-edition/columnists/fissile-materials-working-group/the-year-nuclear-material-security, Accessed on May 23, 2010.

[27]Vlad Sambaiew, "Controlling nuclear materials must be top priority," *The Des Moines Register*, February, 2010. http://www.stanleyfoundation.org/resources.cfm?id=412. Accessed on May 23, 2010.

[28]Li Bin and Liu Zhiwei, "The contribution of arms control to fighting nuclear terrorism," *Disarmament Forum*, No 2, (Geneva: 2003), p. 18.

[29]International Atomic Energy Agency, "Illicit Trafficking and Other Unauthorized Activities Involving Nuclear and Radioactive Materials: Fact

Sheet," *International Atomic Energy Agency*, 2006.

[30]Quoted in Jerome M. Hauer, "Preparing the country for nuclear terrorism," *The Bulletin of the Atomic Scientists,* October 7, 2016. http://thebulletin.org/preparing-country-nuclear-terrorism9985, accessed on October 18, 2016.

[31]Ibid.

[32]Kenneth N. Luongo and Brig. Gen. (Ret.) Naeem Salik, "Building Confidence in Pakistan's Nuclear Security," *Arms Control Today,* December 2007.

[33]Barack Obama, "Obama: How we can make our vision of a world without nuclear weapons a reality," *The Washington Post,* March 30, 2016.*https://www.washingtonpost.com/opinions/obama-how-we-can-make-our-vision-of-a-world-without-nuclear*-weapons-*a-reality/2016/03/30/3e156e2c-f693-11e5-9804-537defcc3cf6_story.html?utm_term=.8779df4479a2,* accessed on October 22, 2016.

[34]Ibid.

[35]"Nuclear Security Summit 2016 Communiqué," The White House, Office of the Press Secretary, April 01, 2016. https://www.whitehouse.gov/the-press-office/2016/04/01/nuclear-security-summit-2016-communiqu%C3%A9, accessed on October 22, 2016.

[36]Quoted in Gideon Hanft, "Rationality and Nuclear Weapons: Revisiting Kenneth Waltz," *Georgetown Journal of International Affairs,* October 24, 2011. http://journal.georgetown.edu/rationality-and-nuclear-weapons-revisiting-kenneth-waltz/, accessed on June 13, 2016.

[37]Rod Lyon, *A shifting Asian nuclear order* (Australia: The Australian Strategic Policy Institute, September 2016), p. 5.

[38]Walter C. Ladwig III, "A Cold Start for Hot Wars? The Indian Army's New Limited War Doctrine," *International Security*, Vol. 32, No. 3, Winter 2007/08,

[39]William Perry, "William J Perry on nuclear war and nuclear terrorism," *Bulletin of the Atomic Scientists*, December 8, 2015.

[40]Rod Lyon, *A shifting Asian nuclear order,* op. cit. p. 16

[41]Ibid. p. 13.

[42]Press Briefing by Press Secretary Josh Earnest, Office of the Press Secretary, The White House, April 04, 2016.

[43]"In early June 2016, army chief Gen Raheel Sharif appeared to have summoned key ministers to GHQ in Rawalpindi. " FarhanBokhari, "Diplomatic Pitfalls, *Dawn,* July 5, 2016. Rizwan Asghar, "Rethinking Deterrence Stability," *The News International,* July 3, 2016.

[44]"Angry Modi spews vitriol against Pakistan," *The Express Tribune,* October 10, 2014. http://tribune.com.pk/story/773363/onus-on-pakistan-to-de-escalate-conflict-indian-foreign-ministry/, accessed on October 22, 2016.

[45]"Army rubbishes Indian 'surgical strikes' claim as two Pakistani soldiers killed at LoC, *Dawn,* September 29, 2016. http://www.dawn.com/news/1286881/army-rubbishes-indian-surgical-strikes-claim-as-two-pakistani-soldiers-killed-at-loc, accessed on October 4, 2016. "India hits Pakistan terror launchpads in surgical strikes along LoC," *The Indian Express,* September 29, 2016. http://indianexpress.com/article/india/india-news-india/india-conducted-surgical-strikes-last-night-in-pok-to-safeguard-our-nation-defence-ministry-3055715/, accessed October 4, 2016.

CONCLUSIONS AND ANALYSIS

Naeem Salik

Pakistan's nuclear program is viewed by its people as the ultimate guarantor of the nation's security and sovereignty. In a politically fragmented country the nuclear endeavor has persistently drawn support across the political, religious and ethnic divisions and has been a truly national enterprise. After the tragic events of 1971 wherein Pakistan had lost its eastern half, its leadership carried out what former Foreign Minister Abdul Sattar has termed as a 'painful reappraisal' and arrived at the conclusion that given the widening gap between the conventional military capabilities vis-à-vis India, further accentuated by that country's burgeoning nuclear program, Pakistan was left with no option but to initiate its own military nuclear program. However, given the post-NPT international environment which was further vitiated after the Indian nuclear test in May 1974, it was never going to be an

easy task. Pakistan had to defy all odds and find its way around a series of obstacles erected after 1974 to achieve its objective. Much has been made of Mr Bhutto's figurative statement made in 1965 about Pakistan's determination to match India's effort to acquire a nuclear weapons' capability even if the Pakistanis had to eat grass or even go hungry. In the event, Pakistan was able to achieve its objective without ever coming anywhere near eating grass or facing starvation despite all the sanctions imposed by the United States beginning in April 1979. It is a tribute to the skills, determination and dedication of Pakistani scientists and engineers that they mastered some of the most complex technologies despite a limited indigenous technological infrastructure.

Despite having acquired the technological wherewithal for a functional nuclear device by the mid-1980s Pakistan exercised restraint and resisted the temptation to flex its nuclear muscles by testing a nuclear device as India had done a decade ago. However, its hand was forced by India's multiple nuclear tests in May 1998 accompanied by a threatening and provocative rhetoric by some of its senior political leaders. Pakistan responded with its own nuclear tests a few weeks later to demonstrate its nuclear capability and to restore the strategic balance in South Asia. Since then, Pakistan has made it clear that its nuclear capability is driven purely by its national security concerns and is India-centric. It neither has any desire for regional domination nor has it staked any claim for a seat at the UN Security Council. With a view to creating a stable strategic and security environment in South Asia, Pakistan had proposed a comprehensive 'Strategic Restraint Regime' as far back as October 1998. However, due to Indian refusal to consider or discuss the proposal it remains an unfulfilled dream. India on

its part has not come up with any alternative proposal of its own. As a result, there is no overarching institutionalized mechanism in place in South Asia to manage recurring crisis situations between the two neighbors or to create strategic stability that could prevent undesirable conflicts and to create a conducive environment for a negotiated settlement of outstanding disputes. On the contrary India's adoption of a provocative conventional military doctrine not only poses a constant threat to regional security but also challenges the credibility of Pakistan's nuclear deterrence. Pakistan, with a sizable part of its military committed in counter terror operations along its borders with Afghanistan and faced with this threatening military posture along its Eastern border besides heightened incidents of aggression along the LOC has been forced to lower its nuclear threshold by introducing battlefield nuclear weapons.

Pakistan's nuclear doctrine is based on the concept of 'Credible Minimum Deterrence,' remains dynamic and has been evolving in line with its security environment. Since Pakistan's nuclear doctrine is intended to deter aggression at all levels of conflict and denying India the freedom to exploit its conventional superiority, it remains sensitive to changes in India's conventional as well as nuclear doctrines. Pakistan has in the aftermath of nuclear tests in 1998 established effective custodial controls over its nuclear assets by way of establishing strong institutionalized command and control structure that is backed up by requisite legal framework in the form of the NCA Law approved by the parliament in 2010. Beginning with a rather modest organization the command and control structure has expanded considerably but it essentially remains an assertive centralized command and control system.

In the last decade or so concerns have frequently been expressed by some international quarters about the safety and security of Pakistan's nuclear arsenal given the complicated internal security environment and the raging conflict in neighboring Afghanistan. While some of these worries could be legitimate most others were driven by motives other than genuine concern about safety and security of nuclear weapons and materials and have been cyclical in nature recurring periodically. Pakistan on its part has invested heavily in terms of resources both financial and human into strengthening the safety and security of its nuclear materials and facilities. It has been working closely with the IAEA and has been an active participant in the Nuclear Security Summits held between 2010 and 2016. These efforts have gradually won international recognition as is evident from the recent NTI Nuclear Security Indexes.

In terms of nuclear specific legislation Pakistan has done substantive legislative work in the form of PNRA Ordinance (2001), Export Control Act (2004), NCA Law (2010) being the salient features of this effort. Additionally, control lists associated with the Export Control Act 2004 have been prepared in line with the NSG, MTCR and Australia Group Guidelines and the implementation and enforcement mechanisms in the form of Strategic Export Controls Division and high powered Oversight Board have been established. PNRA on its part has developed a series of regulations to fulfill its mandated obligations. Pakistan has also submitted five comprehensive reports to the 1540 Committee of the UN Security Council.

Pakistan has been an active participant in the multilateral fora associated with the non-proliferation regime. However, it decided to stay out of the NPT when it came up for signatures to safeguard

its national security interests since India had opted to stay out. Pakistan had proposed a South Asian Nuclear Weapons Free Zone as far back as 1974 which was endorsed by an overwhelming majority of the UN member states but this proposal could not come to fruition due to Indian opposition. Pakistan also made several constructive proposals to India in the 1980s including a regional nuclear test ban treaty, mutual inspections of each other's nuclear facilities etc. Pakistan has been a member in good standing of the IAEA and has an active cooperative relationship with the organization. All of Pakistan's civilian nuclear facilities are under IAEA safeguards and it has never been found in violation of its safeguards obligations.

After the idealistic declaration in 2009 at Prague by President Obama the euphoria about a nuclear free world has dissipated and new era of force modernizations and expansions is underway in the US as well as the Russian Federation. Even more disturbing is the fact that the strategic arms reduction process between US and Russia has been stalled due to strained relations between the two countries. In South East Asia, DPRK is moving headlong in its pursuit of nuclear weapons capability and has been testing newer and more capable delivery systems despite UN sanctions and international opprobrium. The US decision to deploy Terminal High Altitude Area Defense (THAAD) systems in South Korea ostensibly in response to DPRK's provocations is being viewed by China as a threatening development. Nuclear terrorism and cyber-attacks on nuclear command and control and installations continue to be dangerous possibilities.

In South Asia, Indian and Pakistani nuclear competition has

moved into a new arena – the maritime domain – with its peculiar dangers and technical difficulties in exercising effective command and control over a submerged submarine. Deployment of nuclear weapons at sea in the absence of any agreement to avoid 'Incidents at Sea' would be fraught with dangers especially given the fact that bulk of international shipping carrying energy supplies passes through this area. The two countries are also in the process of developing MIRVed systems. Pakistan in response to India's pursuit of BMD systems and India ostensibly to match a similar effort by China. Such technological developments will generate their own pressures and push the arms competition farther and into more and more sophisticated domains.

Pakistan realizes that nuclear weapons are there to stay in South Asia unless some miraculous changes take place in the regional and international security environments. At the moment such a scenario appears, at best, to be a remote possibility. In this backdrop, it is imperative for India and Pakistan to seek strategic stability by maintaining a semblance of conventional military balance, show restraint in the development and deployment of nuclear weapons and associated delivery systems and move towards negotiated settlement of their outstanding political disputes. It will be essential to create institutionalized restraint and crisis management mechanisms and resume a comprehensive, sustained and result oriented dialogue process that is insulated from periodic shocks resulting from the actions of non-state actors on either side.

AUTHORS' BIOGRAPHIES

Amb. Ali Sarwar Naqvi is presently serving as the founding Executive Director of the Center for International Strategic Studies (CISS), an independent and autonomous think-tank for research and analysis of current regional and international strategic issues from a Pakistani perspective. In a long diplomatic career of thirty-six years, from 1970 to 2006, which culminated in senior Ambassadorial positions, served at the United Nations, both in New York and Vienna, and in Washington D.C, London, Paris and Brussels. In the course of professional work, he delivered lectures and speeches on various current affairs issues in many institutions. He has also participated in discussions on various national and international issues and questions on TV and electronic media, both in Pakistan and abroad. After serving as Pakistan's Ambassador to Austria and the IAEA, was appointed Member (Chairman's Advisory Council) in the Pakistan Atomic Energy Commission (PAEC), and functioned as Adviser to the

Chairman PAEC on International Affairs, with particular focus on IAEA matters.

Dr. Mansoor Ahmed is a Post-Doctoral Research Fellow for 2016-2017 with the International Security Program/Project on Managing the Atom at the Harvard Kennedy School's Belfer Center. He was a Stanton Nuclear Security Junior Faculty Fellow at the Belfer Center during 2015-2016.

He holds a Ph.D. in International Relations from Quaid-i-Azam University, Islamabad. His research interests include various aspects of Pakistani and Indian nuclear programs and policies; fissile materials, non-proliferation, arms control and strategic stability issues with special reference to South Asia.

He was a Visiting Research Scholar at the Cooperative Monitoring Center, Sandia National Laboratories in Albuquerque, New Mexico, USA, from August 2013 to January 2014.

He has also served as a Lecturer in the Department of Defense and Strategic Studies (DSS), Quaid-i-Azam University (QAU), Islamabad from January 2011 to August 2015, and as visiting faculty in the Department of Strategic and Nuclear Studies, National Defense University, Islamabad from 2009-2011.

Before joining the academia, he worked in the Pakistan Audit and Accounts Service from July 2003 to January 2011.

He has been regularly engaged in different Track-II dialogues,

initiatives and simulation exercises on arms control and nuclear issues in South Asia.

Brigadier (Retired) Naeem Ahmad Salik is currently a Senior Fellow at the Centre for International Strategic Studies (CISS), Islamabad. He completed his PhD from the University of Western Australia in May 2015. Between February 2009 and March 2011 he taught at the Department of Strategic & Nuclear Studies, at the National Defense University, Islamabad. He has been a visiting scholar at School of Advanced International Studies (SAIS) at Johns Hopkins University and a Guest Scholar at the Brookings Institution, Washington, D.C. from January 2006 to August 2008. He was also a Visiting Scholar at Stanford University in 2004 and at the Stimson Center in 1995.

During 33 years of military service, he gained experience of Command, Staff, Instructional and research positions. He was part of the team of officers that laid the foundations of Pakistan's Nuclear Command and Control system after the May 1998 nuclear tests. Subsequently he served as Director Arms Control & Disarmament Affairs at the Strategic Plans Division until his retirement in October 2005.

Brigadier Salik holds a Masters in History from the Punjab University (1981), a B.Sc. Honors in War Studies from the Balochistan University (1985) and an M.Sc. in International Politics & Strategic Studies from the University of Wales, Aberystwyth, UK (1989). He served as an Associate Professor

at the Department of Defense and Strategic Studies, Quaid-i-Azam University, Islamabad, from 1994-1996 and has since been teaching various courses related to strategy, nuclear policy, arms control, technological dimensions of warfare and South Asian Security as a visiting faculty member.

His areas of expertise include South Asian security with special reference to Indian and Pakistani policies on Nuclear and Missile Issues, Nuclear and Conventional Confidence Building Measures, arms control and disarmament issues, nuclear non-proliferation regimes, nuclear safety and security and export controls.

His book on '**Genesis of South Asian Nuclear Deterrence – Pakistan's Perspective'** was published by Oxford University Press in October 2009 and his second book entitled **'Learning to Live with the Bomb'** is currently under publication by the Oxford University Press. He has published over 30 research articles in reputed national and international publications.

Mr. Ahmer Bilal Soofi is an Advocate Supreme Court of Pakistan, senior partner of a leading law firm of Pakistan, and the founding and current President of Research Society of International Law Pakistan. He served as Federal Minister for Law, Justice & Parliamentary Affairs during the caretaker setup in 2013. He is a Member of Panel of Eminent Persons OIC and has also served as the Chairman of the UN Human Rights Council's Advisory Committee (Geneva). Mr. Soofi has represented Pakistan before several international courts in various jurisdictions including the ICJ, ICC & ICSID, US District Courts, and UK Commercial Courts.

He has advised in a case under War Crimes Tribunal. Notably, he represented Pakistan before the International Court of Justice (ICJ) in Republic of Marshall Island's (RMI) case against Pakistan on 'Obligations concerning Negotiations relating to Cessation of the Nuclear Arms Race and to Nuclear Disarmament'.

Mr. Soofi is invited frequently to lecture on various aspects of international law issues relating to Pakistan at the National Defense College Islamabad, Command and Staff College Quetta, National Management College Lahore, Naval War College Lahore and several other institutes. He remained a visiting Professor of International Law at the Punjab University for over 10 years and is currently teaching International Law course to probationers at the Foreign Services Academy Islamabad.

Mr. Soofi is the author of over 100 articles and comments printed in leading newspapers and journals of Pakistan. He is frequently invited by electronic and print media for expert comments on international law issues.

Mr. Soofi has also delivered talks and lectures at venues like International Development Law Organization Rome, Regional Centre for Strategic Studies, Sri Lanka, Shanghai University China, Fletcher School at Tufts University USA, Royal United Services Institute, London and Harvard Law School, USA.

He graduated from Government College Lahore with Roll of Honor in debates and later completed his LLB from Punjab University Law College and his LLM from the University of Cambridge, UK.

Dr Adil Sultan completed his PhD from Quaid-i-Azam University, Pakistan, and has MSc degree in Mass Communication and a BSc (Honors) in War Studies. He is a former *Visiting Fellow of Henry L. Stimson Center* Washington DC and Visiting Fellow South Asia at the International Institute for Strategic Studies (IISS) London. He has worked on arms control and disarmament related issues for the last over 12 years.

Dr Sultan has participated in numerous national and international conferences on the nuclear issues and was part of Pakistan's official delegation in several bilateral dialogues besides representing the country in multilateral meetings and other international engagements.

Dr Sultan occasionally writes for the print media and has authored several op-eds. His research articles related to nuclear deterrence and arms control related issues have been published in various national and international journals. He has taught courses on nuclear arms control, nonproliferation and the contemporary nuclear issues at the national Defense University (NDU) and Quaid-i-Azam University, Islamabad, Pakistan.

Dr. Sannia Abdullah is currently a Stanton Nuclear Security Post-Doc Fellow at CISAC, Stanford University. She serves as permanent social science faculty at Quaid-i-Azam University, Department of Defense and Strategic Studies, Islamabad. Previously, Dr. Abdullah was a long-term visiting research scholar at the Cooperative Monitoring Center, Sandia National Labs (NM) i.e. March 2016-August 2017, where she worked on

multiple projects. Her latest research was on Pakistan's pursuit of full-spectrum deterrence strategy and posture, the conceptual nuances and implied ramifications. She presented her findings in different think tanks and offices in Washington, D.C. Her research interests include nuclear proliferation and strategy, and general security issues in South Asia. Sannia is also a blogger for South Asian Voices (Stimson Center, Washington, D.C.). In addition to serving as a Nonproliferation Fellow at Monterey's Center for Nonproliferation Studies (CNS) in 2013 and a SWAMOS alumni of Columbia University (2011), Sannia has been part of several Track-II and Table Top Exercises exploring escalation control and deterrence stability in South Asia.

Saima Aman Sial is a Senior Research Officer and expert in strategic issues at the Center for International Strategic Studies (CISS), Islamabad. Previously, she worked with Pakistan's Strategic Plans Division as an Assistant Director - Research in its Arms Control and Disarmament Affairs Directorate for some years. During this time, she conducted research on a variety of subjects including nuclear strategy, doctrines, safety and security, command and control systems, and arms control and nonproliferation policy.

She is a former Nonproliferation Fellow at the Center for Nonproliferation Studies, California USA (Jan-June 2013); Sandia National Laboratories Albuquerque, USA (June 2013) and Nuclear Nonproliferation Education Center NEREC, South Korea (July-August 2016). She also has a fellowship in International Law from Research Society for International Law Lahore (2008-2009).

Ms. Aman has certificate courses in nuclear disarmament, CTBT: Science and Diplomacy, Assistance and protection against Chemical Warfare agents and Safety and security of Radioactive Sources.

Aman has been a frequent contributor in national and international conferences relating to strategic issues, including being a part of India-Pakistan engagements. She has published widely and frequently contributes in national and international dailies on issues of strategic significance and has. She has taught as an adjunct faculty at Bahria University Islamabad.

Dr. Zafar Nawaz Jaspal is an Associate Professor at the School of Politics and International Relations, Quaid-I-Azam University, Islamabad, Pakistan, where he teaches various aspects of Global Politics & Security; Pakistan's Domestic & Foreign Affairs, Strategic Studies; Nuclear/Missile Proliferation; Terrorism including CBNR Terrorism and Countermeasures; Arms Control/Disarmament; etc. His is also a Lead Researcher/Convener of the Program in Domestic and International Security Communication (DISC) at the School. Dr. Jaspal was the Director of the School from October 5, 2012 to January 18, 2016.

He is advisor on Non-Proliferation to the South Asian Strategic Stability Institute, Islamabad/London and a Course Coordinator at the Foreign Services Academy, Ministry of Foreign Affairs, Islamabad. Prior to joining the University (in August 2002), Dr. Jaspal had been a Research Fellow at the Institute of Strategic

Studies, Islamabad and Islamabad Policy Research Institute, Islamabad, Pakistan.

Dr. Jaspal, as a Guest Speaker/Visiting Lecturer, had delivered and still continues to deliver lectures at many professional and training institutions including distinguished NATO School, Oberammergau, Germany; NATO Defense College Rome, Italy, Center of Excellence: Defense against Terrorism, Ankara, Turkey; National Security & War Courses of Pakistan's National Defense University; Intelligence Bureau Academy, Command and Staff College Quetta; Air War College, Karachi, and Foreign Service Academy of the Ministry of Foreign Affairs, Pakistan.

He holds PhD and M. Phil in International Relations and M.A. in Political Science. He did advance Post Graduate Certificate courses in Peace and Conflict Studies, from European Peace University Stadtschlaining, Austria; Peace Research, International Relations and Foreign Policy Analysis from Oslo University, Norway. He also did CMC Training Course/ Cooperative Monitoring from Sandia National Laboratories, Albuquerque, New Mexico, United States

Dr. Jaspal research interests include Pakistan's National Security, Proliferation of nuclear weapons and missiles systems, particularly in South Asia and Middle East; Arms Control/Disarmament and Nuclear Nonproliferation regime; Trends in the global and domestic politics of Pakistan; Terrorism, particularly CBRN Terrorism; and Bio-security. He won HEC Thematic Research Grant of Rs. 4.0/-Million for a period of 12 months -2015/2016.

Dr Jaspal is a widely published scholar with more than 100 academic research papers, monographs and chapters in edited volumes published in Pakistan and overseas. He participated as a speaker in more than 200 National and International Seminars/ Conferences/Workshops/Group meetings etc. He supervised two PhD and 50 M Phil thesis. He had regularly (Oct 2005-Sept 2013) wrote a weekly Column for *Weekly Pulse* Pakistan's leading English weekly and since May 2015 has been regularly contributing in *Hilal Magazine* and also contribute weekly column in *Pakistan Observer since* June 2016. He also provides frequent expert commentary to international and local electronic media, i.e. BBC, Voice of America, Russian TV. PTV World & News, Pakistan Radio, Al. Jazeera, Al Arabia, Press TV, local TV channels, etc.

INDEX

A

AQ Khan, vii, 53, 84, 91, 124, 127

Ababeel, 63

Abdali, 61, 203, 204, 218

Additional Protocol, ix, 134, 156, 157, 178, 179, 180, 190, 191

Agha Shahi, 32, 54, 55, 65, 198, 219

Al-Qaeda, 146, 231

Always/Never Paradox, 106,

Arihant, 62

Assured Deterrence, 61

Atoms for Peace, xvi, 94, 96, 148, 149, 169, 178

Australia Group, 79, 135, 151, 161, 254

B

Babur (Hatf-VII), 218

Babur-3, 62

Baghalchur, 11, 13, 26

C

C2, ix, 101, 102, 103, 104, 105, 106, 116

CANDU, ix, 4, 23, 25, 29

Centrifuges, 15, 16, 18, 19, 209, 216

Chashma, 22, 23, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 45, 46, 47, 70, 71, 177, 181

CIRUS, 7, 32,

Cold Start Doctrine, x, 50, 103, 110, 204, 207, 217, 237

CPPNM, x, 86, 134, 157,

Credible Minimum Deterrence, ix, 54, 56, 57, 60, 62, 103, 199, 200, 201, 202, 205, 206, 253

CTBT, x, 77, 153, 154, 155, 156, 164, 264

D

Development Control Committee, x, 111, 112, 115DG SPD, 91, 110

Dr. Abdus Salam, 26

Dr. I. H. Usmani, 3, 4, 11, 26

Dr. Samar Mubarakmand, 15, 19, 43

Draft Nuclear Doctrine, 53, 64, 198, 219

DRDO, x, 103, 109,

Dual Use Technologies, 124

E

ECC, x, 111, 112, 114

Emergency Response Centre, 128

Enriched Uranium, 2, 15, 19, 38, 197, 208, 213, 231

Export Control Act 2004, 79, 151, 156, 254

F

Fabrication, 2, 4, 8, 10, 15, 20, 22, 25, 26, 27, 28, 33, 37, 39, 61, 196, 197

First Strike, 54, 63, 106, 109, 110, 118,

Flexible Deterrence Options, 61

FMCT, x, 77, 155, 158, 159, 160, 165

Fuel Reprocessing, 2, 4, 8, 10, 26, 27, 35, 70

Full Spectrum Deterrence, 61, 205, 206, 207, 216, 218, 263

G

Gas-Centrifuge Plant, 2

Ghauri (Hatf-IV), 218

Ghaznavi (Hatf-III), 218

GICNT, x, 96, 134

Glenn, 51, 150,

H

Hatf-XI, 58

Heavy Mechanical Complex-3, 39

Homi J Bhabha, 97

Horizontal Proliferation, 124, 223, 228

I

ICSANT, xi, 134

Illicit Proliferation Network, 126

Integrated Intelligence System, 90

International Convention on Suppression of Acts of Nuclear Terrorism, xi, 134

Item-specific Safeguards, 71, 180

J

Jammu and Kashmir, 53

Joint Renunciation of Acquisition or Manufacture of Nuclear Weapons, 151

K

K-5, 62

Kahuta, 2, 15, 33, 221

KANUPP, xi, 3, 4, 5, 8, 9, 10, 13, 15, 20, 21,22, 23, 24, 25, 26, 27, 29, 30, 34, 37, 38, 39, 42, 70, 176, 177, 179

Kargil, 52, 155, 236

Khushab Nuclear Complex, 23, 24, 39, 196

KNFC, xi, 22, 23, 24

KRL, x, 99, 114, 125, 126, 132

Kundian Nuclear Fuel Complex, xi, 22, 26

L

Line of Control, 53, 205, 241, 243

London Suppliers Group, 8, 78, 79

Low Force Zone, 15

M

Miniature Neutron Source Reactor, 38

Miniaturization, 39, 59

MIRVs, xi, 63

MPC&A, xi, 127

MTCR, 135, 161, 254

Munir Ahmad Khan, 3, 5, 7, 18, 19, 24, 26, 31, 36, 41, 42, 45, 46,

Mutual Inspections of Nuclear Facilities, 152

N

NASR, 58, 59, 61, 109, 110, 201, 202, 203, 204, 217, 218

National Institute of Safety and Security (NISAS), xii, 183

National Nuclear Security Action Plan (NSAP), xii, 127, 135, 183

National Nuclear Security Emergency Coordination Centre, 75

National Policy on Waste Management, 74

National Security Advisory Board, xii, 64, 109, 217

National Security Council, 52

NCA Act, 87, 88, 89, 91

NESCOM, xi, 88, 114, 132

NFU, xii, 94, 103, 106, 109, 139, 212, 251, 252

Normal Accidents Theory, 122

NSG, xii, xvii, 34, 50, 78, 80, 135, 147, 156, 157, 158, 161, 163, 164, 228, 229, 230, 245, 254

NSS, xii, 121

Nuclear Command and Control System, 51, 52, 259

Nuclear Materials Security Index, 136

Nuclear Posture, xx, 57, 58, 60, 61, 62, 94, 109, 195, 197, 200, 201, 205, 223, 224, 226, 237

Nuclear Safety & Security, xii, 173

Nuclear Security Action Plan, 75, 127, 135, 183

Nuclear Security Summit, xii, 90, 121, 128, 134, 157, 234, 235, 242, 254

Nuclear Security Training and Support Centers, 134

O

Operational Safety Review Team, xii, 177, 181

Oxide Gas, 12

P

Pakistan Atomic Energy Commission, xii, 11, 25, 71, 95, 96, 114, 135, 176, 233, 257

Pakistan Institute of Engineering and Applied Sciences (PIEAS), xiii, 183

Pakistan Nuclear Regulatory Authority Ordinance 2001, 72

Pakistan Nuclear Safety and Radiation Protection Ordinance 1984, 72

Pakistan's Centre of Excellence for Nuclear Security,134, 136

Personnel Reliability Program, xiii, 133

PHWR, 4

PINSTECH, 3, 11, 12, 18, 22, 24, 25, 36, 38, 186, 188, 189

PNRA, xiii, 72, 73, 74, 75, 88, 127, 128, 135, 181, 183, 184, 254

Pokhran, 7

Proactive Operations Doctrine, 60, 200,

201
PSI, 86

R

Raad, 203, 218
Radiation Detection Portal Monitors, 129, 134
Radiological Security, 134
Radiological Terrorism, 224, 225, 231, 232, 233, 234, 235, 242
Republic of Marshall Islands, 91

S

Safeguards Agreements, xviii, 34, 71, 168, 179, 190
SECDIV, xiii, 79
Security Division, 127, 128, 129, 130, 132, 133, 135
South Asia Zero Missile Zone, 152
SPD, xiii, 112, 113, 114, 115, 126, 128, 133, 134
SPD Training Academy, 128, 134
Strategic Culture, 102, 103, 104, 116
Strategic Export Control Division, xiii, 79
Strategic Force Commands, 113, 114
SUPARCO, xiii, 114, 132
Symington and Glenn Amendments, 51, 150

T

Tactical Nuclear Weapons, xiv, 40, 201, 203, 226, 237, 240
Terminal High Altitude Area Defense (THAAD), 255
Trident Nuclear Ballistic Submarines, 226

U

UNSC Resolution 1540, 68, 84, 87, 146
Uranium Enrichment, 13, 15, 16, 33

W

Waltz, 236
WMD, 143, 145, 146

Y

Yellow Cake, 13, 16, 17, 21, 22, 26

Z

Zirconium, 18, 22, 23

Pakistan's nuclear programme has been mired in controversies since its very inception. When Pakistan decided to pursue a military nuclear capability as an insurance against future threats to its security and integrity in the aftermath of the 1971 debacle, the Non-proliferation Treaty (NPT) had already entered into force in 1970 and its effort was seen to be in contravention to the fledgling international norms against further proliferation of nuclear weapons. Its plans to systematically build up its nuclear fuel cycle facilities were upended by India's first nuclear test in May 1974 that also triggered the introduction of increasingly stringent controls over exports of sensitive materials and technologies especially to countries suspected of pursuing military nuclear programmes. Pakistan's subsequent efforts to circumvent these restrictions and adopt unconventional means to acquire necessary materials and technology against the wishes of world powers created an image of illegitimacy that has refused to fade away. The revelations in 2004 of the activities of the AQ Khan network have further reinforced the negative view of Pakistan's nuclear enterprise.

Pakistan's intellectual response to hostile propaganda about its nuclear programme has been rather weak and disjointed. It has only been in recent years that a few publications that project the Pakistani perspectives on the subject have appeared. However, while these publications provide a historical overview of the programme the contemporary issues and developments have not been adequately covered while some issues though directly associated with the nuclear programme have not been addressed at all. Recognising these deficiencies in the Pakistani nuclear narrative, the Center for International Strategic Studies (CISS), Islamabad, whose main area of interest is nuclear policy, has taken up the challenge to fill this void through the publication of an edited volume entitled "Nuclear Pakistan Seeking Security and Stability."

Price: Rs 500

COLORWINGS